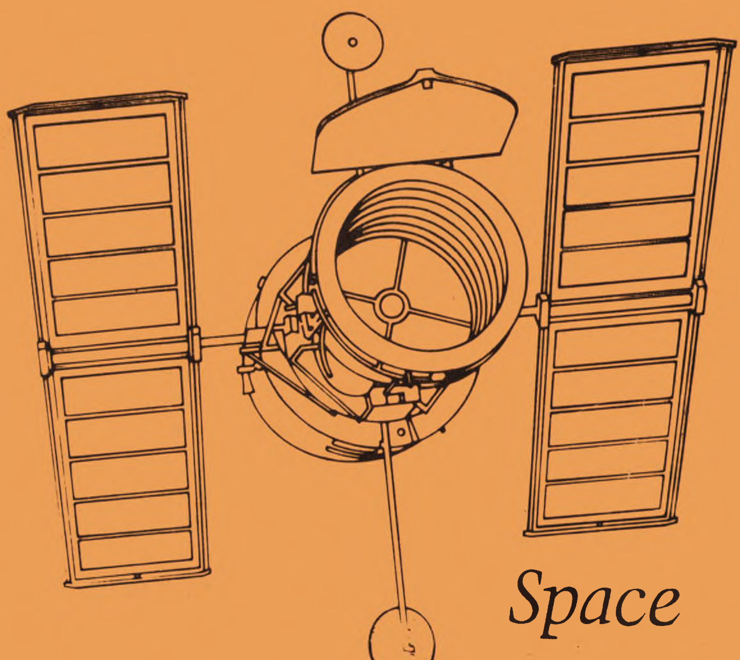
NOVA NOTES



NASA

Space Telescope

BI-MONTHLY JOURNAL OF THE HALIFAX CENTRE

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1983 HALIFAX CENTRE EXECUTIVE

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NOTICES

The Halifax Centre of the R.A.S.C held Astronomy Day on 23 April, 1983. It consisted of two major events, an observing session held in the parking lot and a showing of a variety of astronomical films in the theatre/auditorium of the Nova Scotia Museum. From the positive comments by the large number of visitors the event was quite successful.

The Annual Dinner held on 6 May, 1983 at the Henry House took the place of the monthly meeting for May. The next monthly meeting for the Halifax Centre will be 17 June, 1983 and the speaker (tentative) will be Graham Millar who will tell us all about Babylonian Astronomy. This meeting will be 8:00 PM, Friday, 17 June, 1983. The meeting will be in the lower auditorium/theatre with access from the parking lot and side entrance. Refreshments will follow.

One or more camping/observing weekends have been sheduled for this summer. Although there are no firm dates at present the 15th to 17th July and the 12th to 14th August have been suggested. Dr. Holden, our Honorary President, has generously offered his facilities for the August dates. More information later.

OBSERVING AT SHUBIE PARK

The Dartmouth Parks and Recreation Department has invited us to present an observing session for them at Shubie Park. This is part of their recreation programme and will take place on Sunday, May 15th, and if cloudy, on the following day. The observing session will begin about 8:00 PM.

Tentative plans call for a short talk in the portable classroom followed by the actual observing. I welcome suggestions for the subjects for the talk and/or volunteers. It promises to be an enjoyable evening - so come, bring your telescope or binoculars, and share some of your enthusiasm for astronomy with the general public.

Those who have been to one of our observing sessions at Shubie will agree that it is a good compromise between accessibility and dark skies, and will be pleased to learn that the Dartmouth Parks and Recreation Department has kindly offered to let us use the site and facilities (ie; a room to warm up in and make hot refreshments!). We should be able to make good use of that offer.

David Tindall

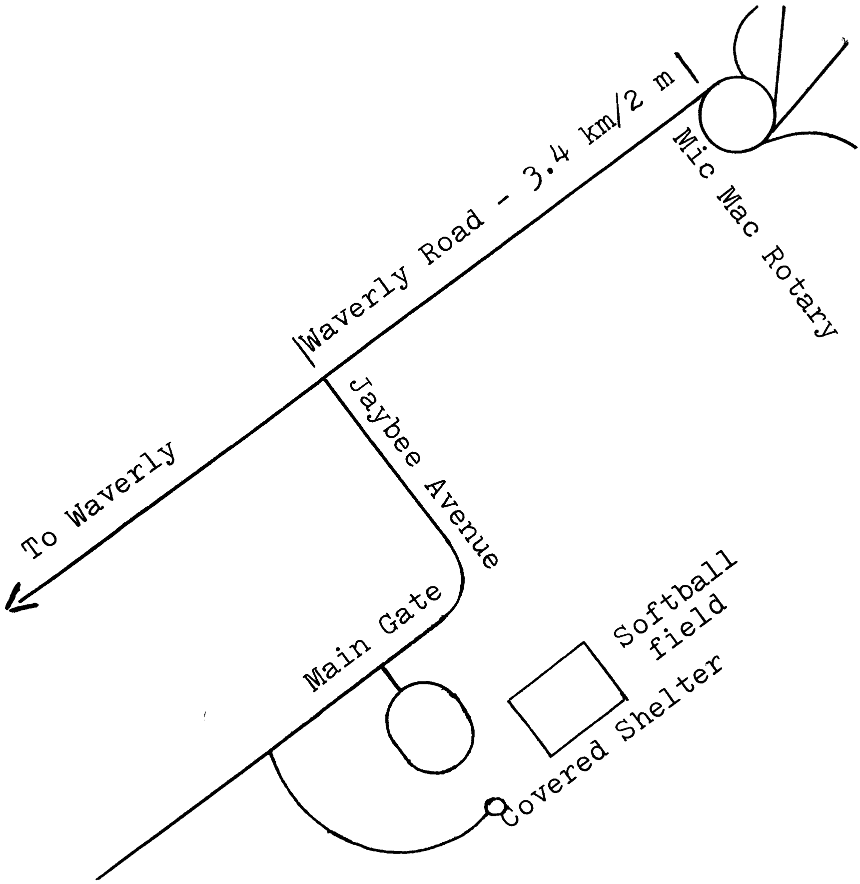
DIRECTIONS TO SHUBIE PARK

Although you may not receive Nova Notes in time to take advantage of the above observing session it will nevertheless be very helpful to keep these directions for future reference since further sessions for Shubie Park are being considered and you might want to go there on your own.

To get to Shubie, take the old Waverly Road turn-off from the Mic Mac rotary. Then drive 3.4 km to Jaybee Avenue (on left).

The Park is located at the top of Jaybee Avenue. The recommended spot is the softball field, located just below the main entrance to the park - you can turn right or left when you enter. A dirt road going past the main gate will take you directly there.

Kathy Oakley



MINUTES OF MARCH MEETING

The March meeting of the Halifax Centre was held on March 18th, with our Vice President, David Tindall, chairing the session. Randall Brooks and Walter Zukauskas were the speakers.

Randall's presentation was on the history of astronomy in Nova Scotia from 1750 to 1915. We learned that most of the astronomy in Nova Scotia was used as a tool for surveying and marine navigation. The first astronomer of any note being M. Charbert who while at Louisburg in 1761 and 1769 recorded the transits of Venus.

Toward the middle 1800's colleges and schools such as the Royal Acadian School in Halifax, the Seminary in Pictou and Kings College at Windsor were teaching astronomy. There is still some evidence of an observatory by the playing field in Windsor. (The dome is presently in South Milford.) In some of Randall's research there was also evidence of some observatories in Halifax. There was the Naval Observatory at the Dock Yard from 1858 to 1881 and another one across from St. Paul's Church (1869-1912).

Walter traced the Halifax Centre beginnings with the Halifax Mechanics Institute & Library from the early 1800's to the present. Through the great driving force of Father Burke-Gaffney the Nova Scotia Astronomy Society was formed in 1951. In 1955 the Society was accepted as a centre of the R.A.S.C. Some people of note that participated during this time were Don Crowdis, Rube Hornestein and R.I. Baglole. Toward the late 60's the Centre diminished. Through the efforts of Barry Mathews the Centre started up again in Sep. 1970. Since then it has been going very strong.

MINUTES OF APRIL MEETING

On April 15th, Dr. Ken Dunn of the mathematics department at Dalhousie University was the Centre's guest speaker. Dr. Dunn's subject was Black Holes and Big Bang Cosmology.

Scientists described black holes as early as the late eighteenth century. However, there were no grounds for light to behave this way until the proclamation of Einstein's Theory of Relativity in 1916. It then became clear that light was bent by gravity. Dr. Dunn stated that there are two aspects in the discussion of black holes. One is the discussion of stellar evolution and the other is the discussion of mathematical models of the gravitational field force.

In the mid 30's it was fairly understood how the nuclear reactions were going on and what happened after a period of time when the nuclear fuel was used up. The first models built were those of the size of our Sun. After hydrogen was used up it would expand into a red giant and finally contract down into a white dwarf and eventually die. A star of larger mass would not pass through the white dwarf stage. By the end of the 30's it became a little clearer that larger stars of 2 or more solar masses would expand like the smaller ones and then go into a Nova or Super Nova stage. The explosion would blow off considerable mass but not enough for it to go into the white dwarf stage. It would then contract further and be exclusively made up of neutrons with a density of 10^{15} gm/cm^3. Thus a neutron star.

In the larger size stars (greater than 3 solar masses) the expansion, contraction, Nova or Super Nova stage would be gone through but not enough matter would be blown off to enter the white dwarf or neutron star stage.

There is no stable configuration. It collapses to where the gravitational force would be so large that not even light can escape. A complete collapse of an object is called a 'Black Hole'.

The two mathematical models that Dr. Dunn spoke of were the Schwarzschild solution model and the Kerr solution model. The first model describes the gravitational field of a non-rotating body. The Kerr solution describes this with a charged, rotating body. In the Schwarzschild solution, as the collapsing star shrinks into the black hole configuration it literally disappears from the universe. In the Kerr solution, matter can collapse into a black hole, pass through a worm hole and come out again elsewhere in space and time (from one universe into the next). It could go on infinitely but never back to our universe.

Wilf Morley

ABSTRACT 11

The mass of LMC X-3
Is larger than we like to see
In ordinary neutron stars,
In spite of all our error bars.

The primary which we can see:
A normal star of middle B -
Except for some continuum
Arising from its little chum,
Appears to be exactly right
In size and its amount of light.

So we judge its normal weight
Should lie between just 4 and 8,
Which may imply its other role:
Companion to a blackish hole.

The DAVID DUNLAP DOINGS

SUPERNOVAE

TYPE ONE SUPERNOVAE

These are older stars with masses only slightly greater than that of our sun. The radiation from their explosions is very great, although the mass of the gaseous cloud does not exceed several tenths of the mass of the sun; they are found in elliptical and spiral galaxies. Such supernovae have characteristic times for their brightness to decline after the explosion occurs; a good example is the Crab Nebula.

TYPE TWO SUPERNOVAE

These are initially massive, hot, young stars, usually occuring in the spiral arms, where the process of stellar formation is localized. A number of stars of spectral class O probably end their existance in spectacular explosions. The mass of the gases expelled may exceed the mass of the sun. The material, therefore, requires a greater time to disperse than the less massive type one. They occur only in spiral galaxies; the powerful radio source in Cassiopeia (Tycho's Supernova) is type 2.

Let us assume that a supernova of type 2 exploded somewhere in the galaxy 100 years ago. An explosion of this type normally occurs only in a thin region near the galactic plane, within a thickness, d, of some 100 parsecs. The galactic orbit of the sun is now within this thickness. If r is the characteristic size of the spiral arms of our galaxy, and d the thickness of the region of the galactic plane in which a supernova of type 2 can occur, then the volume of the disk in which such supernovae can occur is $\pi r^2 d$. Consider a spherical region of radius, R, which surrounds the sun. Its volume will be $4/3 \pi R^3$.

The ratio of the volumes of these two regions of the sphere to the disk will be $4/3 \pi R^3 / \pi r^2 d$. The ratio of these volumes is also the probability that, when a chance supernova explosion occurs somewhere within the galaxy, the sun will be at a distance less than or equal to R from the explosion. We see that R must always be less than or equal to d. Therefore, since $4/3 \pi R^3$ is always less than $\pi r^2 d$, the probability that the sun will be near any particular explosion is less than one as, of course, it should be, since a probability of one indicates a certainty of occurance.

If one supernova occurs on the average every T years, then a "nearby" explosion will occur every

$$t = \frac{\pi r^2 d}{\frac{4}{3}\pi R^3} T = \frac{3r^2 d}{4R^3} T \text{ years}$$

Let us put numbers in the equation, assuming that r equals 10,000 parsecs, d equals 100 parsecs, R equals 10 parsecs, and T equals 100 years. We find that t equals 750 million years. If we believe our estimates for t to be reliable and since the sun formed 4.6 billion years ago, then this has happened $4.6 \times 10^9 / 7.5 \times 10^8 = 6$ times.

Michael Boschat

CHARLES MESSIER

The French astronomer, Charles Messier (1730-1817) was the first to compile a systematic catalog of nebulae and star clusters. In his time a nebula was the word used to describe any fuzzy astronomical objects.

Messier was the first in France to observe the awaited-for return of Comet Halley in 1758-1759. This event inspired Messier to become an ardent searcher for new comets, and was called the comet ferret by King Louis XV. He independently discovered a number of them (about 15-21) and observed many more.

In 1760 he began compiling a list of nebulae so that he could distinguish better between nebulae and comets since both types look very much alike when looking through a small telescope like the one that was available to him.

Many of these listings of nebulae, including some of the most prominent, are still known by his catalog number. The catalog is still in general use today and a valuable guide to amateur astronomers.

Peter Steffin

FOCUSING ON CONSTELLATIONS

URSA MAJOR: The Great Bear.

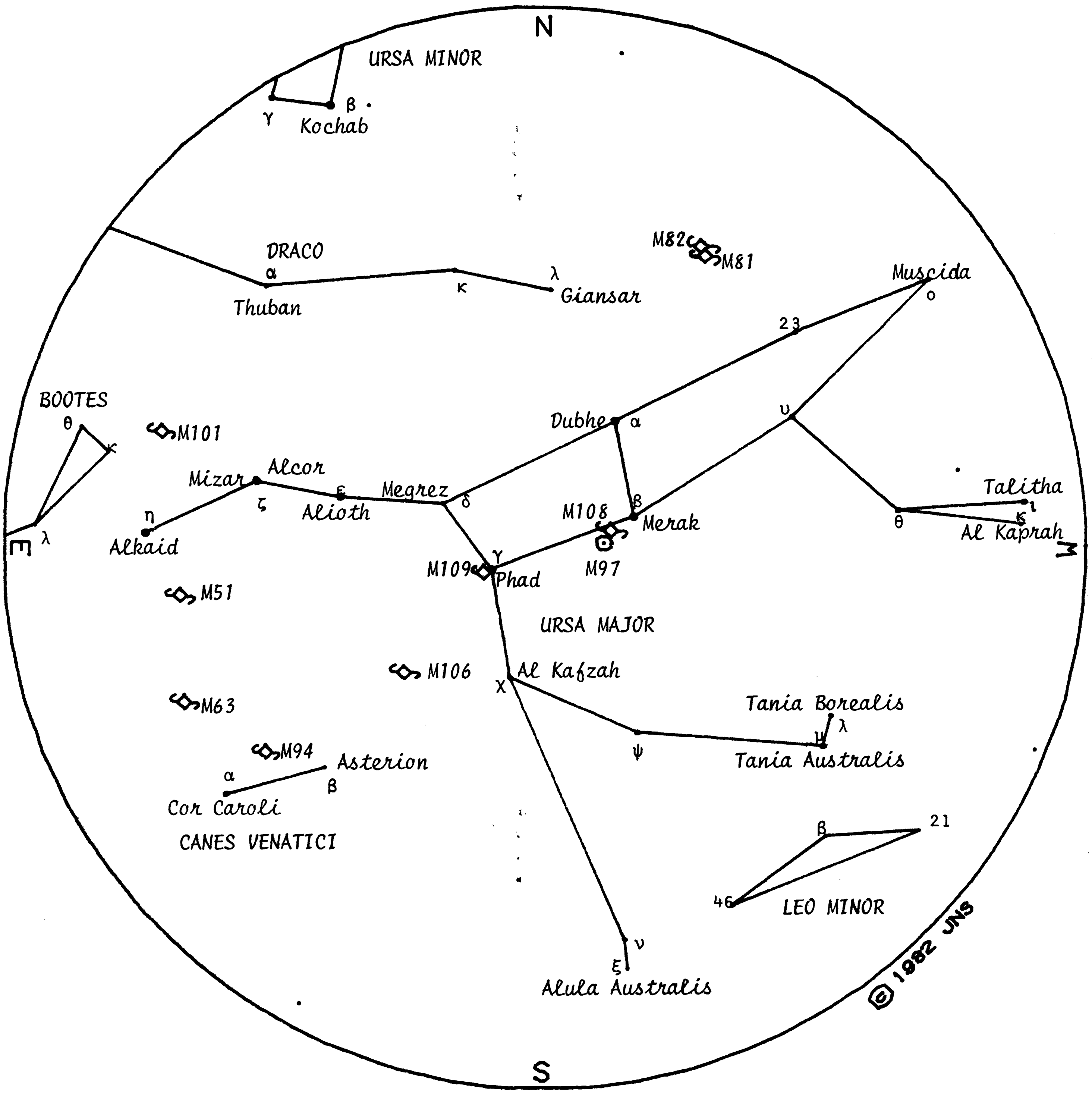
Since everyone reading this article should have no problem finding the big dipper and knows the stories behind the Great Bear, I shall limit my discussion here to the non-stellar objects that are found in and around the constellation. That is not to imply, however, that the several binaries in the constellation are not worthy of observation.

The pair M81 and M82 are just over $\frac{1}{2}^{\circ}$ apart and can be found easily with a small telescope. M81 is a spiral galaxy like the Milky Way, and is only about 4-5 times further away than the Andromeda galaxy. M82, a physical companion to M81, is an irregular galaxy with no indication of a spiral pattern. M82 is also a strong radio source and has had what seems to be a violent explosion in its centre about 1½ million years ago. The explosion was estimated to involve several million solar masses and displays itself today as a filamentary structure extending away from the galaxy's central region. One suggestion is that this galaxy's centre is a black hole containing hundreds of thousands of solar masses. The two galaxies form the nucleus of a small cluster of galaxies, not unlike our own Local Group of Galaxies.

The Owl Nebula, M97 - a rather large planetary nebula, is only $2\frac{1}{2}^{\circ}$ from Merak, and about $3/4^{\circ}$ from M108, an edge-on spiral galaxy. Both these diffuse objects are challenges for small telescopes. M101 is a beautiful, large (but faint) face-on spiral and is very worthwhile searching for with a small telescope. M109 is a barred spiral galaxy.

There are four interesting galaxies in the Canes Venatici region. M106 is a large, bright spiral; M63, the sunflower galaxy, is a faint spiral; M94 is a very bright, compact, and nearly circular spiral; and finally the well-known M51 and companion. M51, the Whirlpool Galaxy, is a magnificant, face-on spiral with a smaller, irregular galaxy "attached" at the end of its northern arm. M51 should be visible on a very dark night in good binoculars, but a 10" telescope is needed to trace the spiral arm pattern.

Norman Scrimger.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COVER STORY

SPACE TELESCOPE

The year 1985 is eagerly anticipated throughout the science world as the time scheduled by the National Aeronautics and Space Administration for orbiting Space Telescope. All of the agency's astronomy efforts during more than a quarter of a century are expected to improve technologically by a quantum jump with this new adventure in discovery.

The difference between Space Telescope and optical telescopes viewing the sky from present ground observatories can be compared to the difference between Galileo's first telescope and its predecessor, the human eye.

Looking through our atmosphere into space, even with the most advanced telescopes available, presents an insurmountable problem - the atmosphere itself. In optical astronomy the best observing conditions occur only a relatively few nights of the year. Observations on other nights are either blocked by bad weather or diminished in clarity by haze or heat currents. Besides visible light only a few narrow bands of radiation, in the infrared and radio portions of the spectrum, can penetrate our atmosphere.

The Space Telescope won't have this distortion problem and its imagery will be sent to Earth by electronic means, to be converted into clear pictures that astronomers and other scientists can study. The instrument will be able to see objects 50 times dimmer than anything seen now, and it will be able to observe for 40 percent of a 24-hour day on the average. What the human eye will view via this new space craft for the first time will be literally a part of the Universe 350 times larger than ever before seen.

This new instrumentation will be used in observing our own Solar System. Space Telescope will be able to view our planetary system routinely, with a level of detail that can only be bettered by sophisticated spacecraft flying near or orbiting the planets. Astronomers will examine the clouds of Venus, the polar ice caps and deep valleys of Mars, and the dynamic atmosphere and moons of Jupiter. The rings, moons and clouds of Saturn will also be observed and the Space Telescope will even furnish us information about the outermost planets, Uranus, Neptune and Pluto, that ground observations can not obtain.

Not only will the Space Telescope provide information about our own Solar System, but it will also be used to search for clues of the existence of other solar systems. Although the telescope may not be able to see any planets that might be orbiting around even the next nearest star, Alpha Centauri, it should be able to note any perturbations in motions of nearby stars that would indicate the presence of orbiting planets.

There are 37 stars within 15 light years of our own Solar System and 10 Sun-like stars within 10 light years. The Space Telescope will be directed toward these stars and toward the 100 to 500 additinal nearby stars that might host planetary systems. Should the telescope detect planetary systems around any of these stars, it would raise new possibilities that extraterrestrial, even intelligent life, may exist.

The Space Telescope will consist of an Optical Telescope Assembly much like the reflecting telescopes used on Earth, a Support Systems Module, and Scientific Instruments. They all work together as one unit in space to return imagery and other information to Earth.

Courtesy NASA

BRIGHT SOVIET FIREBALL

From the Crimea comes a report of a bright fireball observed in Uzbekistan and Turkmenistan.

Unfortunately no magnitude was given in the report, but it probably would have been near minus 20m. The fireball was observed for 1.8 minutes by observers. One of these observers used 20X100mm binoculars and observed 40 meteors surrounding the main body. The total length of the fireball was 6 - 7 degrees, and it was accompanied by explosions.

The author, at Kiev University, remarked that it reminded him of the fireball procession that was observed in the area in 1913. He was referring to the Kirklids which were thought to be a natural earth satellite similar to our moon but much smaller. They concluded that it was in an equatorial orbit.

Of course with so much "junk" up there it is hard to tell a fireball from a satellite burn-up since they are similar. One way to make a determination would be to obtain a spectra of these objects. It is quite possible that the Crimea group did observe a meteoric body entering the atmosphere, much as has been seen right here in the maritimes.

Michael Boschat

NEW MEMBERS

The Halifax Centre of the R.A.S.C. welcomes the following new members:

Stephen Breen
Norma Fraser
Michael Grace
Richard Swan

GOOD SEEING!

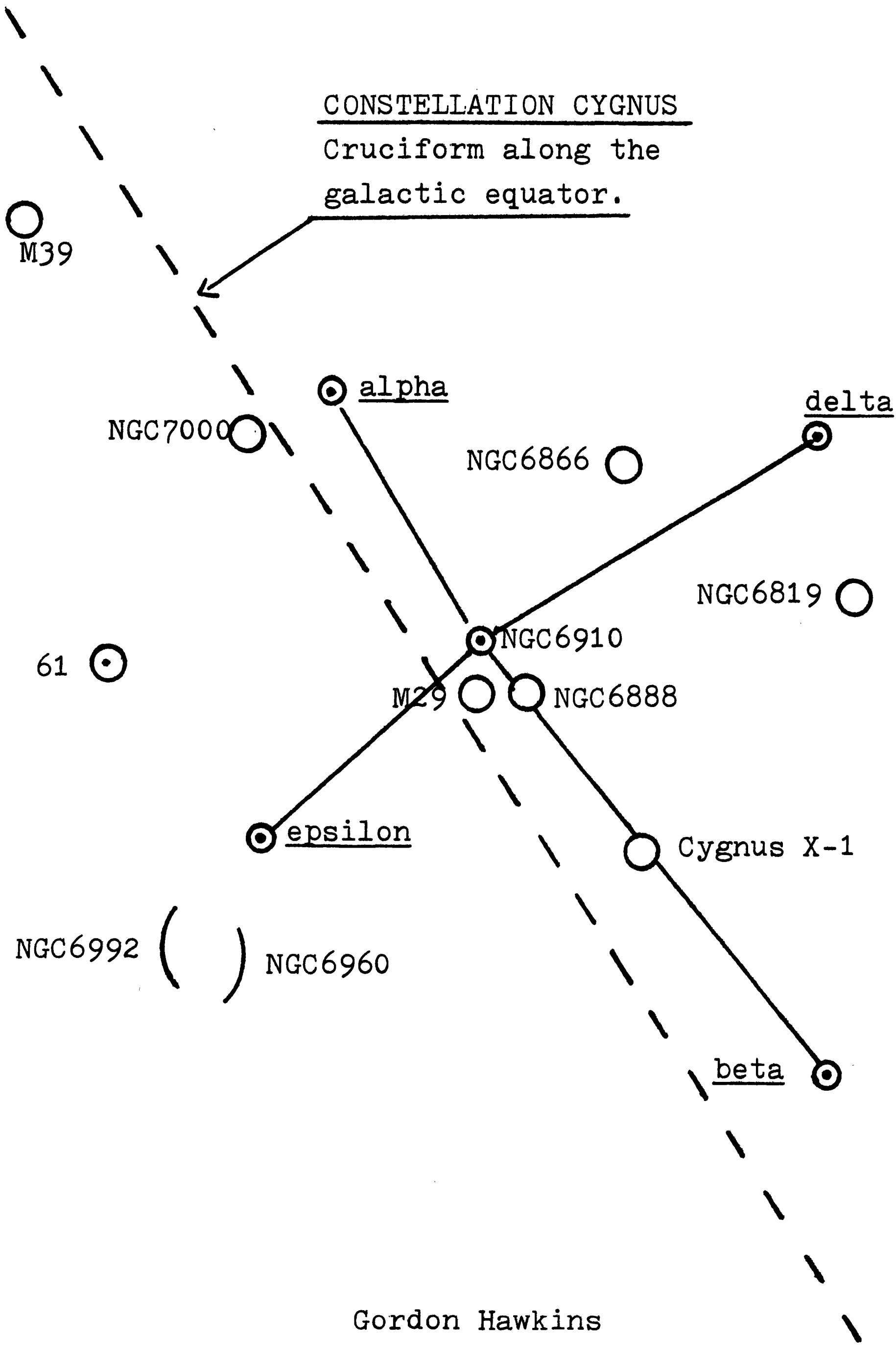
A LOOK AT THE CONSTELLATION CYGNUS

Cygnus with its rich star fields and nebula, rises late in the early part of May and offers an excellent target for the small telescope. To find Cygnus, look for it in the galactic equator.

Cygnus is a fine cruciform constellation. Sweeping the telescope through the Milky Way part of the constellation is quite rewarding, especially when one is in the dark skys of the country where there is a minimum of light pollution.

The star Deneb or Alpha Cygni is the 19th brightest star in the sky. Deneb is a blue-white supergiant with a spectral class A2 and a magnitude of 1.3. The star is very brilliant compared to the Sun and outshines it by 60,000 times. Deneb is at the top of the cross. If you drop all the way to the bottom of the cross, you will find the star Beta Cygni or Alberio. It is the most famous double star in the sky. Beta Cygni is really three stars according to spectroscopic data, but requires a telescope to be seen. When you are looking through the eye piece, you will see a third magnitude orange star with a spectral type K3 and the other is a fifth magnitude star with a spectral class of B8. The companion lies 35 seconds of arc away, near a position angle of 55 degrees. The field around this double star is rich with other stars and is seen best with a wide field eye piece and telescope of small aperture.

Another double star is 61 Cygni. This double star is particularly suited for a small instrument. A person observing visually will see two orange stars. The two components have a spectral class of K5 and K7.



Gordon Hawkins

A telescope with an aperture of 6cm at a power of 30x will give a good view of the double stars. 61 Cygni is about 11.2 light years away and early astronomers noticed a large proper motion in this system, possibly indicating an unseen companion. In 1942, astronomers determined that a dark body about 8 times as massive as the planet Jupiter revolves around the A star every 4.8 years.

Cygnus X-1 is one of the stranger objects in the sky. It was the first stellar x-ray source recorded. The main star has a surface temperature of 30,000^{o}K. This supergiant is very hot and luminous, with a spectral type BO 1b. Studies carried out in 1973 indicate that a strongly heated stream of gas passes from the B component to an unseen companion. An unbelievable amount of x-ray emissions originate from this area as hot gases are pulled into an invisable something. This is strongly purported by astronomers to be a black hole.

Astronomers believe the invisible companion is a fully collapsed body with a mass in the range of 15 to 20 times of the Sun. The object is crammed into a space which is only 160km in diameter. Calculations indicate it is too small to be a white dwarf or neutron star. Astronomers think that it might be a black hole.

Two degrees south and slightly east of Gamma Cygni you will find M-29. In your finder you will see a hazy patch that will resolve into an open cluster and shining at 7th magnitude, containing a dozen or more stars in a trapezoidal shape.

In a telescope of 15cm aperture and at a power of 50x the cluster is not as rich as many other open clusters.

Against the background of the Milky Way the cluster does not stand out as much as it could if it was situated in a darker part of the sky. Discovered by Messier, the beauty of the cluster lies in this dense, dust-filled section of the sky.

Another cluster, M-39 was also found by Messier. It is a better target than M-29 and is a very loosely structured cluster. It lies north-east of Deneb and is easy to find with binoculars, but the cluster is too wide for long focal length telescopes. The twelve brightest stars in the cluster are either A or B types and are scattered over a field about $\frac{1}{2}^{\circ}$ by $\frac{1}{2}^{\circ}$, the size of a full moon and almost all of the stars in M-39 are members of the main sequence.

Two famous bright diffuse nebula are NGC-6960 and NGC-6992. Also known by the name Veil Nebula, NGC-6992 looks somewhat like a miniature Milky Way when viewed through a Rich-Field Telescope at low power. When looking for either NGC-6960 or NGC-6992 you should pick a night that is very good for astronomical seeing and where there is very little light pollution. Turn the telescope toward Epsilon (E) region, by the Vulpecula border. This entire region is convoluted with chain after chain of similar nebulosity. These chains of nebulosity are believed to be connected in some way. The clouds are about 1500 light years away and are 70 light years in diameter. The expansion of these clouds is slowed by the dense dust which is common in this region, but this does not stop the expansion because the nebula is like a broom or plow, sweeping up everything in front of it.More stars are visible inside the Veil Nebula than ouside of it since the gas cloud has swept much of the obscuring dust out of the way.

One of the more harder to locate objects in the sky is the North America Nebula. Look for this object where there are dark skys and no light pollution. If you have binoculars, they will show a glow more than $1\frac{1}{2}^{\circ}$ in diameter and if you are lucky you may see its prominent shape. You will see that it has a remarkable field of view with stars sprinkled all over and mixed with gas and dust. The stars are a lot brighter than the nebula itself, which is relatively faint. The best method to locate it is to use a wide field instrument, such as binoculars.

NGC-6888, NGC-6866 and NGC-6819 are all found near Gamma Cygni and are located within 7° of the Star Gamma. NGC-6888 is called the Crescent Nebula and it looks somewhat like the Veil Nebula but in a miniature form. This nebula lies in a rich star field as almost all objects in Cygnus. To find this object you must have both, dark skies and good seeing conditions.

NGC-6866 is the next object and only 4.7° from the star Gamma. In a 15cm or 20cm telescope at 60x, the object, a tight compact cluster, shows about 2 dozen stars of 8th magnitude.

NGC-6919 is a nice object about 7° from Gamma Cygni. The outer part of the cluster is framed by much brighter stars. This patch contains about 150 10th magnitude stars within its boundaries. With a large aperture instrument at medium to high power the cluster will readily come to view.

Burnham's Celestial Handbook, Vol. 11 will give a much more detailed background to this most fascinating constellation.

Gordon Hawkins

HALIFAX CENTRE MEMBERS BY AREA (AS OF 7 APRIL 1983)

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