

* Event Horizon *

Editorial

As I read all these articles over each month, (I do so, Grant) I've noticed something that may confuse a reader from far away. Throughout the winter, half of us were commenting on the sub-zero temperatures and chilling observing sessions. The other half were pointing out this unusual mild winter we've been having. So, what was it, freezing or mild? Well...yes, I mean, everyone is right. And we have been experiencing these completely opposing temperatures on a by-weekly basis, one week of mild and then a quick drop to brisk winds and the occasional flurry, for about a week. And not many clear breaks on any night. But we're not giving up. A few of us have caught a bug from Ann. The Variable Star bug. We can't give up.

I have to take a moment and give Ev Butterworth the credit she so rightly deserves. She writes a few regular features in this newsletter, but even better than that, she always gets them to me more than two weeks before the deadline. Your an editor's dream Ev, thanks.

I guess that I say this same bit over and over again, thanking everyone for submitting articles, and so on. Well, here I go again. I can't help it, because it's those people who save my neck every month. Imagine a 5 page newsletter - I can't. Thanks everybody.

Patricia Marsh
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Happy
Valentine's



Chair's Report

Here we are, on the threshold of February, and (so far) we've had one of the mildest winters I can remember. It seems to be loved by all, with the exception of us astronomers. We've had NO CLEAR SKIES to speak of -- that is until last night. And, wouldn't you know it, I had a prior commitment and COULDN'T LOOK!!!

However, it hasn't been exactly quiet in the HAA! Therefore, in chronological order, let me elaborate ...

First of all, **Rachael Carson** ran her first HAJA meeting, to critical acclaim. She was quite concerned afterwards that she hadn't done a very good job, but I want to assure everyone (and especially Rachael) that it was a **magnificent** effort, for a first-time or anytime! If this is the worst that Rachel

can do, then look out -- we have a powerhouse on board!

After the latest General Meeting, a record number of us went out to dine at the newly refurbished Kelsey's (used-to-be Chaps in Westdale). While all seemed to be well at the beginning of the party, it wasn't long before the dreaded "egg-disease" reared its ugly head. A raw egg mysteriously appeared on the table, and **everyone** had a go at trying to make it stand on its end, even though the stars were no longer in alignment. Didn't matter -- it stood anyway. So much for witchcraft and miracle cures.

Bill Tekatch hosted an extremely successful Cosmology Group, with the topic of "Life". It seemed the most difficult aspect of the topic was in defining it in the first place. **John Feild** pointed out that almost every currently accepted definition of "life" could be satisfied with a description of "fire", which implied that fire was alive. A most heated (fiery?) debate ensued, arguing whether fire was life or life was fire. Discussion groups like this that inspire such braincell activity are a *warm* way of chasing Winter's doldrums.

A bunch of us, along with some



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members of the Aquaknights (a renowned scuba diving club), jaunted off to the Cinesphere at Ontario Place last weekend to see a movie called *Destiny in Space*. Imax treated us to the most sublime motion sickness by racing us through the valleys of Mars and streaking over the surface of Venus a la computer graphics, all to the accompaniment of probably hundreds of speakers **everywhere** blasting out the roar of rockets. While this was certainly impressive, I confess I found the "trailer", a little gem of a movie whose name I am at a loss to remember, to be the most fascinating. This movie was an overview of the evolutionary processes of life on Earth, with an emphasis on how interrelated and interdependent humans and all other living things really are. The movie referred to this symbiotic relationship as "the green contract". These kinds of outings are fun for all ages, and I would like to personally thank **Bob Botts** and his **Aquaknights** for including the HAA.

Later that same evening, **Ev Butterworth** hosted an observing workshop entitled *Variable Stars*, with **Ann Tekatch** as the guest speaker. I don't think it's any stretch of imagination to say that Ann held us rivetted for the entire event. She finished the very illuminating discussion about the nature of variable stars and the methods used to observe them with a mini version of practical variable star observing. She showed us all that it is both easy and fun to observe variable stars. We all decided that it would be a great idea to have a Variable Star Section in the HAA, and promptly awarded Ann with its leadership. So saying, we adjourned to the Phoenix to celebrate the birth.

I know that NOBODY out there EVER has time to watch TELEVISION, so my next question is probably moot, BUT ... did anyone happen to catch our own famous physicist **Doug Welch** in his latest "15 minutes of fame" on the Discovery Channel in mid-January? I understand that Coppola and Lucas are vying for his signature on contract as I speak, but I'm hoping that he'll still have time for the HAA (or we'll relocate to Los Angeles, where the skies make Hamilton's look positively inviting).

Keep spreading the gospel, Doug!

The Web page has had a few changes made to it, as those of you who regularly surf no doubt will have seen. All issues of *Event Horizon* from September 1994 to January 1995 are now online, as well as an enhanced weather page which now contains downloadable movies and images of Southern Ontario straight from the satellites. So if you want to know if it's raining, don't touch those drapes ... log on! For those of you with an Internet account, you should have received a detailed explanation of how to install the software necessary to access the Web. If you have an account, but didn't receive the info, it's probably because I don't know your address. So tell me, and I'll tell you!

Finally (whew!), I will indulge in a little nepotism (yea, even honesty), by acknowledging the contribution of my wife's life as a Martian in the composition of the article *Pen Pal Wanted* in this month's issue. In the past, Doreen has done yeoman's duty by going over my articles with a fine-tooth (lice) comb and modifying spelling and grammar, and generally putting commas where they ought to be. When it came to the pen-pal article, I had lots of facts and an embryonic idea, plus a blank screen. It was the last item that threw me. It didn't throw her. Thanks, Doreen!

Grant Dixon
Chair

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Surf's Up!

Do you ever get the feeling that you are living in California, I mean, with all this talk about surfing?

Well, for those local surfers, of the net of course, I have come across some Web home pages that may be of some interest.

For the Amateur Telescope Makers there is a web site located at:
<http://stargate.promus.com/public/ASTRO/scope.html>

For the Radio Astronomy enthusiasts there is a web site at:
<http://IRSociety.com/0c/sara.htm>
(the 0c is the number zero)
(the htm| is the double bar, not the letter "L" - for some reason I can't even get the double bar to print on this newsletter)

Solar observers and eclipse hunters may enjoy this web home page:
<http://umbra.gsfc.nasa.gov/sdac.html>
or
<http://umbra.gsfc.nasa.gov/eclipse/predictions/eclipse-paths.html>
or
<http://umbra.gsfc.nasa.gov/eclipse/951024/rp.html>

I just finished downloading the image below of the May 10 1994 annular solar eclipse. I also collected an image of the sun through an H-alpha filter. Nice.

Check this one out. Any ideas whose home page this is?
<http://dogwood.physics.mcmaster.ca:3001/Doug.html>

In case you missed last month's newsletter, here is our own home page on the web:
<http://www.science.mcmaster.ca/HAA/index.html>

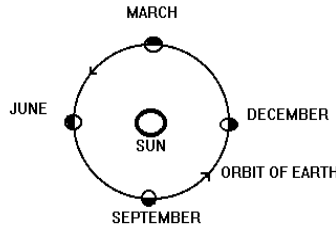
Patricia Marsh

Notes for the Novice

Even if you are lucky enough to have a telescope, it cannot be used properly until you know where to point it. Without the knowledge of the brighter stars, and of the general positions of the constellations, the sky will never make sense. The main patterns of the constellations are not difficult to learn if you have the right help. Once you have made out a few 'landmarks' in the sky, the other stars will fall more easily into place.

One difficulty in working out the star patterns is that they appear in different parts of the sky at different times of the year, even though we may be observing at the same hour of the night. For example, on an early spring evening, as soon as it gets dark, the Big Dipper will be overhead. Another look on an autumn evening at the same time will find it low in the north, almost touching the horizon. In fact, many constellations are completely invisible for three or four months of the year, because the Sun has moved into their region and they are above the horizon only during the day.

The diagram is a view of the Earth's orbit around the Sun, as seen from



somewhere out in space. We are looking from the north side of the orbit, and so the Earth is going around the Sun in a counter-clockwise direction. A well-known star group named Orion (the Hunter) is shown. (diagram not to scale) Half the Earth is in sunshine, the other half is in night, with a twilight zone in between. Stars can be seen only from the night half. When can we see Orion? Starting in December, we find that Orion can be seen very well, because it is on the opposite side of the Earth to the Sun. As the Earth's spin on its axis makes the Sun set in the west, so Orion is rising in the east. Three months later, in March, Orion's direction has drawn nearer to the Earth's twilight zone. It now lies to the left of the Sun in the sky, and sets in the west not long after darkness has fallen. By April it has been lost in the twilight. Throughout spring and summer, Orion

faces the day side of the Earth and cannot be seen.

The Pole Star is the most useful star in the sky because it is always in the same place. All the other stars move slowly around the sky as the seasons change, but the Pole Star remains at the north point of the heavens. It is purely by chance that the north direction of the Earth's axis points towards the bright star that we call the Pole Star.

Surrounding it are the constellations of the northern sky that never set below the horizon. We call these constellations that never set circumpolar. The Great Bear, or Ursa Major is one of these constellations. It is found on one side of the Pole Star. In this constellation we find the asterism, the Big Dipper. It can always be seen when the sky is dark, any time of the year. On the other side of the Pole Star we find a large 'W' shape that we call Cassiopeia. Once you have found these two and the Pole Star, called Polaris (part of the Little Dipper, or Ursa Minor) the northern sky will never seem strange again and you will enjoy watching these as they slowly turn around each other with the passing seasons.

With the Pole Star found, turn your back to it and you will be facing directly south. The star maps supplied in this newsletter show the night sky as you will see it when you look up at different times of the month. The circle is the horizon, and the zenith or overhead point is in the middle of the map.

Patricia Marsh

AQUARIUS

M M E Q F O R V Q C G A T V D
 N J T I A T J N R O O I T X H
 P U U J Q D F S I I I E T E S
 Z L S M G Q N U E P P P E G U
 S H U O O I F I E R J O K E R
 W Q V R A U V R Q O S I J M U
 G Z R I R E T A T C U S I I A
 H S O O I U J U P S N S W N T
 B E C N K H D Q E U G A T I R
 U T A R E C N A C S Y C N X E
 L O R E T S E I R A C S C O C
 D O D V M O G H M G R B Z D A
 A B Y N X Z T C U E X O O E L
 T Q C S U E S R E P V E G A L

Celestial Cartography

The following is a brief history of astronomy with the emphasis on the evolution of star mapping.

15 000 BC Ice age people begin to keep records of the moon cycle by scratching marks on bone. The moon's phases begin to be counted. Several star patterns are identified with gods and mythological creatures.

1200 BC The Babylonians carve a boundary stone showing the Sun, Moon, Venus and several constellations.

700 BC The Assyrians and Babylonians define the Zodiac. The celestial sphere is divided in 360 degrees. The Phoenicians engrave star positions on clay tablets in cuneiform script. The Egyptians inherit the Zodiac and add it to some of their own constellations as we can see on the roof of the temple of Hathor at Dendera. They produce a 365.25 day year and divide the day into 24 hours.

350 BC? The Farnese atlas, the oldest surviving celestial globe, is carved in Greece. This marble sculpture depicting Atlas carrying the heavens shows 42 constellations.

220 BC Archimedes (287-212 BC) builds a mechanical celestial sphere powered by water.

140BC Hipparchus (160-127 BC), chief librarian in Alexandria, develops a star catalogue of about 850 stars. He also discovers the phenomenon of precession by comparing star positions in ancient tables with his own.

150 AD Ptolemy (100-170 AD), working in Alexandria, assembles a treatise which contains a section of astronomy that includes a catalogue of 1022 stars. He divides the stars into 48 constellations, lists each star with its name based on its position within the constellation (Orion's right shoulder, etc.) and includes ecliptic

latitudes and longitudes. This catalogue formed the basis for all star charts until the XV century.

980 Al-Sufi(903-986), a Persian astronomer, writes *The Book of Fixed Stars* which is illustrated with individual constellations.

1252 Moorish and Arabian astronomers assemble a revised star catalogue and tables of planet positions under the sponsorship of King Alphonse of Spain. They were known as the Alphonsine tables in his honour.

1314 Levi ben Gerson (1288-1344), a Hebrew astronomer, invents the Jacob's staffs for measuring angles.

1437 Ulugh Beg (1394-1449), a Mongolian-Turkish ruler and astronomer, builds the Fahkri sextant, the largest meridian instrument ever constructed, and uses it to correct Ptolemy's tables.

1460 Regiomontanus (1436-1476), a mathematician in Nuremberg, dissatisfied with Ptolemy's imprecise star positions, decides to remedy the problem by starting a long observational program. It was continued after his death by Bernard Walther.

1512 Nicolaus Copernicus (1473-1543) publishes his *Commentariolus* that had the Sun at the center of the planetary system. It goes against the prevailing theory of the Ptolemaic system which has the Sun revolving around the earth.

1515 Albrecht Durer (1471-1528), a famous artist and mathematician from Nuremberg, publishes the first printed star maps. These planispheres are polar projections of the celestial sphere. One contains 18 northern constellations and the 12 of the zodiac, the other contains 15 southern constellations.

1521 Ferdinand Magellan (1480-1521), a Portuguese navigator, travels south discovering two irregular star clouds which were later named after him.

1551 Gerardus Mercator (1512-1594), creator of the Mercator projection,

engraves copper plates for the first mass-produced celestial globes. They consist of 12 slices and two polar caps which could be pasted onto cardboard spheres. COMA BERENICES appears here for the first time.

1572 Tycho Brahe (1546-1601), a Danish astronomer, notices a "new star", the supernova in Cassiopeia. This discovery challenges the notion that stars were unchanging.

1575 Brahe builds the first modern observatory, Uraniborg, and works to correct current star charts. His tables are used to construct the globes of Plancius and Blaeu, and Bayer's *Uranometria*.

1589 Petrus Plancius (1552-1622) produces a globe where, for the first time, we find CRUX and TRIANGULUM ANTARCTICUS. He also defined COLUMBIA, CAMELOPARDIS and MONOCEROS.

1602 Dutch navigators Frederick de Houtman and Pieter Dirksz Keyser compile a catalogue of southern stars. They are the first Europeans to chart the stars around the Antarctic pole and they define the constellations of CHAMAELEON, DORADO, GRUS, MUSCA, HYDRUS, TUCANA, VOLANS and PAVO. Based on ancient Chinese constellations, they also define the PHOENIX, INDUS and APUS.

1603 Johann Bayer (1572-1625) publishes his *Uranometria*, an atlas of 51 copper engraved maps containing 1706 stars, many designated with Greek letters. He is the first to include new southern constellations.

1609 Galileo Galilei (1564-1642), professor of mathematics in Italy, manufactures his first telescope which magnified just 9 times.

1610 Galileo discovers four moons of Jupiter and publishes his *Messenger from the Stars*. In 1616 he appears before the Inquisition for his Copernican views. In 1632 he publishes *Dialogue Concerning the Two Chief World Systems*, with the backing of the church; nevertheless it gets him a sentence of house arrest for

the rest of his life.

1618 Johannes Kepler (1571-1630) publishes his book *The Harmony of the World* in which he explains how, by using Tycho Brahe's data on the orbit of Mars, he was able to deduce the laws of planetary motion and proposes that the orbits of the planets are elliptical with the sun at one of the foci. His very precise *Rudolphine Tables* give a new impetus to astronomy.

1659 Christiaan Huygens (1629-1696) discovers Saturn's brightest satellite.

1667 Louis XIV has the Paris Observatory built. It is still in use.

1671 Isaac Newton (1642-1727) constructs the first reflecting telescope with a 1.5" mirror.

1673 Johannes Hevelius (1611-1687) observes and charts the features of the moon, the paths of comets and the positions of stars. His fine charts introduced the constellations CANES VENATICI, LACERTA, LEO MINOR, LYNX, SCUTUM, SEXTANS and VULPECULA.

1676 Edmond Halley (1656-1742) charts the southern stars with far more accuracy than Keyser and Houtman.

1678 Halley publishes his new data in a catalogue and two charts of the northern and southern hemisphere. He later predicted the return of a comet in 1758, and even though he never saw it, we now know it by his name.

1676 John Flamsteed (1646-1719) is appointed Astronomer Royal in the new Observatory at Greenwich. He works on the first catalogue of northern stars and a set of celestial charts. Friends, Crosthwait and Sharp, complete and publish them after his death.

1752 Nicolas Louis de Lacaille (1713-1762), a French astronomer, makes a telescopic survey of the southern hemisphere from Table Mountain at the Cape of Good Hope. His catalogue listed 9800 stars.

1754 Lacaille returns to Paris presenting

to the French Academy of Sciences his large map containing many new constellations: SCULPTOR, FURNAX, HOROLOGIUM, RETICULUM, CAELUM, PICTOR, PYXIS, ANTILIA, OCTANS, CIRICINUS, NORMA, TELESCOPIUM, MICROSCOPIUM AND MENSA. He divided Argo into CARINA, PUPPIS and VELA.

1758 Charles Messier (1730-1817), a French observer, spent most of his life looking for comets. He makes a list of 104 "nebulous" objects which he cannot identify, complete with drawings, coordinates and descriptions.

1780 Lemonier Lalande (1732-1807), in his *Astronomie*, depicts 88 constellations. He attempts to give them boundaries and tries to change Leo Minor into "Felis", his cat. A method of joining the main constellation stars by simple lines is devised in order to reduce the clutter.

1781 William Herschel (1738-1822) discovers Uranus. He and his sister Caroline make more than 400 lenses and mirrors.

1787 Herschel constructs a very large telescope, 40 ft. long, with a 48" mirror, which he uses to discover two satellites around Uranus and, in 1789, two more around Saturn. He catalogues close to 2500 nebulae.

1833 John Herschel (1792-1871), William's son, plotted thousands of new objects during the five years he studied the southern hemisphere.

1837 Friedrich Bessel (1784-1846) measures the distance to a star, 61 Cygni.

1845 William Parsons (1800-1867), Lord Rosse of Ireland, builds the largest telescope of the time, a giant 72" reflector. In 1850 he presents his observations of the spiral structure of some "nebulae."

1864 John Herschel combines all previous "nebula" lists and publishes them in one General Catalogue containing 5000 entries.

1882 David Gill (1843-1914), director of the Royal Observatory at the Cape of Good Hope, obtaining an excellent photo of the comet of 1882, is inspired to make a photographic catalogue of the southern stars. Three years later, he publishes a catalogue of photographic plates with 454 875 stars from latitude -18 to the south pole.

1884 Greenwich is finally accepted as the Prime Meridian by the scientific community.

1887 The Astrographic Congress meets in Paris and agrees to produce a photographic catalogue of the entire sky. Although never completely finished, this "Carte du Ciel" is published in 1964 with 22 054 plates.

1888 J.L. Dreyer (1852-1926) brings Herschel's catalogue of nebulae up to date and renames it the New General Catalogue (NGC.) It contains 13 000 entries including later supplements.

1909 Percival Lowell (1855-1916) predicts the existence of Pluto, which was found by Clyde Tombaugh twenty years later, in 1929.

1910 Norton's star atlas is published.

1924 Edwin P. Hubble (1889-1953) calculates the distance to the Andromeda and Triangulum "nebulae" using cepheid variables. He announces that these "nebulae" are not only outside our galaxy but are galaxies unto themselves- perhaps the most important discovery of this century.

1929 Hubble measures the redshift of the spectra of galaxies and announces that the universe is expanding.

1932 Harlow Shapley (1885-1972) publishes his catalogue of 1250 bright galaxies.

1932 The International Astronomical Union establishes some order in the different constellations. It settles on 88, simplifies their names and establishes their boundaries.

From 1933 to the present, many star charts have been published, the most complete being long exposure photographic surveys.

Rob Roy
692-3245

Greek in the Round

Leo the Lion, one of the most dramatic constellations in the sky does not have much lore surrounding him. It has often been considered the nemean lion that Hercules destroyed. Also coinage was stamped depicting the lion in many cultures, because of his mightiness and association with royalty. This month I'll concentrate on the brightest star in Leo, Regulus, hovering a mere half degree from the ecliptic. Because of this position we will often see the moon and planets come close to Regulus and occasionally occult the star. I'll also take a look at the famous Leonid Meteor Shower which every 33 years heralds a spectacular show. Look for it in 1999.

"Regulus", "*The Little King*", "*The Lion's Heart*", "*the Kingly One*", "*The Star of the King*", "*Regia*" or "*The Royal One*". By any other name, is almost always associated with royalty. Tycho called the star *Basiliscus* evidently from the Roman title *Basilica Stella*. The modern name *Regulus* given by Copernicus, seems to have no certain

connection with the famous Roman general Regulus, whose heroism so inspired the Romans during the first of the three great struggles with Carthage.

Giving approximate millenniums (1 millennium = 2000 yrs): Between 4000 to 2000 BC Regulus (Summer Solstice in Leo) was regarded by the ancient Persians as one of the four "Royal Stars" of Heaven, the other three being Aldebaran (Vernal Equinox in Taurus), Antares (Autumnal Equinox in Scorpius), and Fomalhaut (Winter Solstice in Aquarius). Due to precession, they have since past into history and lost their positions. The following Cardinal Points from 2000 BC to 0, became Aries the VE, Capricorn the SS, Libra the AE, and Cancer the WS. This is the zodiac still in use today by Astrologers. It is two thousand years out of date. The current Cardinal Points from 0 to 2000 AD are Pisces the VE, Gemini the SS, Virgo the AE, and Sagittarius the WS. From 2000 (approx. 27??) to 4000 AD the Cardinal Points will become Aquarius, the VE, Taurus the SS, Leo the AE and Ophiuchus the WS. The cardinal points are north, south, east and west and do not move on the ecliptic. Through precession, the 26,000 yr. cycle, it is the stars on the ecliptic path which change. (Thanks Bob for helping me with the upcoming Cardinal Points)

Babylonian tablets record observations of Regulus dating from about 2100 BC and it was through a study of such records, and those of Spica that the Greek astronomer Hipparchus detected the Precession of the Equinoxes, about the year 130 BC. The longitude of Regulus had changed by some 28 1/4o, or nearly 2 hours of right ascension, since the first observations had been inscribed on the clay tablets of Babylonia, slightly over 2000 years before.

"Gamma Leonis" or "Algeiba" marks the radiant point (actually 2o to the northwest) of the famous Leonid Meteor Showers which currently reach their maximum on November 17 each year, and stage more or less spectacular displays at intervals of 33 years. This is

the swarm that produced the fabulous meteor shower of November 13, 1833, and the almost equally fine ones of 1799, 1866 and 1966. The Leonids are disintegration products of the Tempel-Tuttle Comet (1866 I) which has a relatively short period of 33.176 years. and whose orbit very nearly intersects that of the Earth. Although some meteors appear each year in November as the Earth crosses their path, the finest displays occur only at third of a century intervals, just after the parent comet has passed. The next great star-shower from the Leonid swarm is expected before dawn on the morning of November 17 or 18, 1999. Also start looking a year or two ahead and after as there may still be good showers to watch.

"It was as if a globe had been filled with moon-light and hung before them in a net woven of the glint of frosty stars..."

Ev Butterworth

Did You Know That ...

one cubic centimeter of "empty space" contains about 8 atoms, air has 100 million trillion.

if our solar system were the size of Sky Dome, our sun would be a baseball in midfield and the nearest star would be a baseball in Houston's Astrodome.

our day lengthens by one second every 62,500 years. In the age of the dinosaurs, the day was only 23 hours long.

Pen Pal Wanted

I'm not a typist, and the other night this proved to be an advantage. While surfing the Web, I accidentally typed 'SSS' instead of 'WWW'. Well, they're not TOO far off! And, lo and behold, up popped something called the 'Solar System Server!' While browsing, I came across a letter which I think would be of interest to our younger members.

Station 37
Nirgal Vallis
Mars
e-mail: "peeblesc@sss.hebes.mr"

Lowell 47, 53

Dear Friend-to-be:

For the past 14 days, a dust storm has raged ceaselessly, with winds roaring at over 300 kilometers per hour. Because of this, I have been stuck in our quonset hut at the construction site, without anyone to play with or talk to. Actually, I never DO have anyone to play with or talk to, except the navvies on the job site, so I am looking for a pen pal.

Perhaps I should tell you a bit about myself first. My mom and dad are engineers here in Nirgal Vallis, helping the giant offworld company JCN Congomerates search for the underground caves that created this valley. Among the first wave of settlers here on Mars, my parents were the first colonists to have a child here (me!), which I guess makes me special, but also makes me lonely. There are a few more children now, but the oldest is only 4 years old (that's 7 Earth years), and I am 7 (that's 13 on Earth), and he doesn't like the same things I do, anyway. I have a baby brother, Garnet, but he doesn't even talk yet!

Oh, I forgot! My name is Carnelian (my parents, in case you hadn't guessed, are mining engineers!).

Usually, I live with my family in a wonderful house on the cliffs overlooking the magnificent Hebes Chasma. The

village of Hebes is nearby, all ranged along the same cliffs. The Chasma (or 'chasm' as it's called on Earth), is similar to the Grand Canyon in Arizona, but a whole lot bigger (everything is bigger on Mars, except the planet itself). The view from our livingroom window is breathtaking. On the plain, I can see right to the horizon, about 8 km. away (the distance we can see is less than on Earth, because Mars, being smaller, curves more sharply away). The beautiful red sand is coloured by rust, and the sky is pink due to dust particles. It's really different from Earth's sky (which Mom tells me is as blue as my eyes, but all over), because, even though it's pink, as soon as you look straight up, it turns almost black because we don't have much atmosphere here (about one/one-thousandth of what they have on Earth). This means that when I play outside, I have to wear a 're-breather' that recirculates the air I breathe in order to purify it and make the most of what oxygen is in it. I also have to wear 'environmental' clothes, which protect me from cold temperatures (sometimes as low as 90 degrees below zero Celsius) and the constant presence of ultra-violet radiation. It sounds pretty fierce, but it's home to me!

When I venture near the edge of the cliff, I can look into the wonderful world of the Chasma. It was caused millions of years ago by the surface of the planet collapsing, and where we live it's almost three kilometers deep! Every once in a while, we're really lucky to see what little water there is on Mars accumulate as ground mist in the Chasma. When this happens, the valley is filled with a magical sea of fog, which bubbles and churns and swirls as if alive. It really is most beautiful.

Don't think that it's only pretty here during the days, though, because in a way, it's prettier at night. Dad says Earth people have one big, shiney, silver moon which takes an Earth month to change from a little sliver on the right side to a little sliver on the left side, having been very big and round in between (I think that's how he described it). Here on Mars, we have TWO moons, and they don't seem to behave

the same as Earth's moon. One of our moons, Deimos, is the smallest moon in the solar system (12 km. across), and it is 24,000 km. away, so it looks just like another star to me. It moves only a little faster in our sky than Mars rotates, so it takes nearly six days to go around the sky. The other moon, Phobos, is bigger than Deimos (21 km. across), but still won't win any prizes for size! But it's much closer to the planet (only about 9,000 km. away), so it appears to be a dot in the sky. Through a telescope, you can see it as new, full, and old, but not with ordinary eyes. It moves so slowly that Mars rotates faster than the moon circles the planet, and so it rises in the West and sets in the East, nearly always twice a day. Silly moon!

Phobos is important, though, for all its funny ways, because it is our 'Statue of Liberty' ... all the colonists land there first, to be checked out by doctors and scientists for diseases before being allowed to live on Mars. Mom and Dad remember the station there as a place of many emotions -- hope, fear, excitement, regret, loneliness -- all rolled into one. They don't know when, or if, they will ever get back to Earth; I for one would like to see it someday, because it sounds so beautiful and vibrant, with things like birds and animals and plants, and all the colours. What is green like?

As you can well imagine, the time I am allowed to spend outside is limited by the hostile environment (try to picture yourself running wearing a big snowsuit and a gas mask!), so I spend a lot of my time in front of my computer or in school or the gym. My favourite hobbies are music and astronomy -- I sing in the school choir and am studying the violin (I'm awful, though!), and I am a junior member of the Hebes Amateur Astronomers. Through the work of the adults mostly, but with some help from a few of us kids, light pollution is a thing of the past. Even at the work camps, only the most essential lights are left on at night, so we can see the stars. And what a sight it is! The starlight is so bright that it casts shadows, something which Dad tells me his great-great grandfather remembers seeing only in the most northern reaches of Canada

when he was a boy in Temagami. Maybe some day I can see some of the places in my family's past.

Oh! The wind has dropped! Mom has just come in to tell me that the weather report for tomorrow is good, with a heat wave expected that might bring the temperature up to 15 degrees Celsius. That means that I can go out and play with only my 're-breather' and a gauze sunshade! Alright!

Anyway, please write me and tell me about your home and your interests! I promise I'll check my Internet account every day, no matter what the weather!

Live long and prosper,

Carnelian Peebles

So what do you think of that? If you don't have e-mail but would like to write to Carnelian, please send your letters to me c/o this newsletter.

Grant Dixon

SCIENCE

Equipped with his five senses, man explores the universe around him and calls the adventure Science.

Edwin Powell Hubble

What's Your I.O.?

Ah, love is in the air. Romance and stars. Stars? Here is your challenge for the month. Will your true love help you?

1) *James Gregory, in 1663. Gregory, a Scottish mathematician, never actually made a reflector (as he admitted, he had no practical skill) and the first reflector was made by Newton, who presented it to the Royal Society in 1671.*

2) *True. The Pole Star is at least 7000 times more luminous than the Sun - but it is about 680 light-years away.*

3) *False. The barycentre is the centre of gravity of the Earth-Moon system. Since it lies well within the Earth's globe, the simple statement that 'the Moon revolves round the Earth' is good enough for most purposes.*

4) *Cygnus (the Swan), which is the only one of these constellations not in the Zodiac.*

5) *(a) Aldebaran (Alpha Tauri). (b) Sirius (Alpha Canis Majoris). (c) Mira (Omicron Ceti). (d) Mu Cephei. (e) Alphard (Alpha Hydrae).*

6) *Sigma Octantis. It lies with one degree of the south celestial pole, but is only of magnitude 5.5.*

Won't you be my valentine? I give you my love of questions.

1) True/False? Phoebe was the Christian name of the American astronomer who discovered Pluto.

2) Which planet has the shortest day, and, to the nearest hour, what is its length?

3) The Gum Nebula in the constellation of Vela is so named because it contains molecules which under terrestrial conditions, would be sticky.

4) Why is the largest crater on Mars' satellite Phobos named Stickney?

5) Who first proved that the

objects formerly called spiral nebulae are, in fact, external systems far beyond the Milky Way?

6) The mirror for a large telescope at the Paris Observatory was made from the porthole of a dismantled battleship.

Do you know your trivia? Good Luck. See you next month.

Io, Keeper of the Flame,
Jupiter Co-ordinator

The Long Term Motion of Comet Borelly

This somewhat belated article is now appearing as I was somewhat busy during the fall. The comet itself gave me a bit of a chase late in the fall as I hunted for it in the morning sky, until finally spotting it on the evening of December 25th. Comet Borrelly itself was discovered by Alphonse Borrelly on the evening of Dec. 28th, 1904 in Cetus as it headed for a mid-January perihelion. The new comet was found to have a period of 6.91 yrs, which had at first made the next returns more favourable than at discovery to become progressively less favourable. During this period the gravity of Jupiter tugged on the comet and increased its period to almost precisely 7 yrs. This situation temporarily locked the time of perihelion passage to within a few days of mid-June causing the comet to missed entirely in 1939 and 1946, and marginally detectable in 1953, 1960, 1967, and 1974. However, by the 1974 apparition Jupiter had shortened the comet's period to about 6.8 yrs, setting up conditions for the favourable returns of 1981, 1987, and 1994. The future motion of P/Borrelly is shown in Table 1. This is derived from simulations ran on the program Dance of the Planets v2.71 QED, orbital

Table 1: P/Borrelly 1905 II - 1905 to 2102

Favourability					
T	q(au)	P(yr)	Dmin(au)	Rating	
1905 Jan	17.3	1.39	6.91	0.879	M/F
1911 Dec	18.5	1.40	6.80	0.502	F
1918 Nov	17.1	1.39	6.79	0.481	F
1925 Oct	7.5	1.39	6.92	0.984	Mod
1932 Aug	27.3	1.38	6.87	1.503	Mod
*1939 Jun	10.2	1.44	6.98	2.160	U
*1946 Jun	8.5	1.44	7.02	2.167	U
1953 Jun	9.5	1.45	7.01	2.159	U
1960 Jun	13.2	1.45	7.02	2.128	U
1967 Jun	17.7	1.44	6.99	2.103	U
1974 May	12.7	1.31	6.76	2.115	U
1981 Feb	20.0	1.31	6.77	1.393	M/F
1987 Dec	18.3	1.35	6.86	0.483	F
1994 Nov	1.5	1.36	6.88	0.618	F
2001 Sep	9.5	1.36	6.85	1.353	M
2008 Jul	9.3	1.35	6.83	2.225	U
2015 May	5.8	1.35	6.80	2.044	U
2021 Dec	24.9	1.26	6.74	0.545	F
2028 Sept	22.8	1.26	6.74	1.188	M
2035 Jul	2.5	1.29	6.79	2.038	U
2042 Apr	22.5	1.30	6.81	1.972	U
2049 Feb	5.0	1.29	6.74	1.214	M/F
2055 Nov	10.8	1.29	6.76	0.451	F
2062 Aug	9.6	1.29	6.73	1.698	M
2069 Mar	14.4	1.16	6.56	1.705	M
2075 Oct	4.2	1.16	6.55	1.024	M
2082 May	19.7	1.23	6.68	2.215	U
2089 Jan	25.9	1.24	6.69	1.067	F
2095 Oct	1.8	1.24	6.69	1.067	M/F
2102 Jun	5.5	1.24	6.69	2.253	U

* not observed at this return



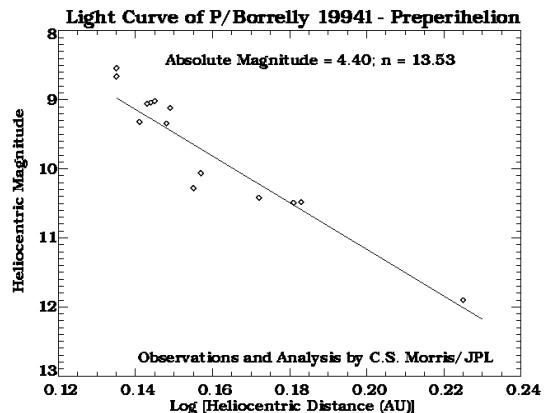
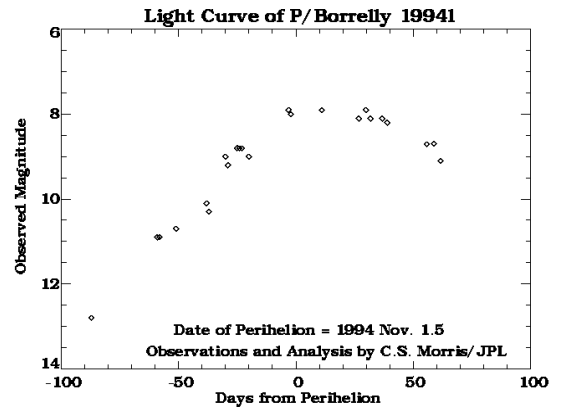
This image is of Comet P/Borrelly taken on 1994 December 9.35 UT by Jim Scotti with the 36 inch Spacewatch Telescope on Kitt Peak. It was generated by co-adding 6 images obtained over about 30 minutes time so the star images can be seen as 6 multiple images offset to account for the comets motion during that time. The image is 18.4 arcminutes on a side with north at right and east at top. The inner coma is highly elongated in the direction of what appears to be a sunward spike projecting just south of east from the nuclear condensation and in the direction of the tail which extends more than 13 arcminutes nearly due westward (towards the bottom) off of the nucleus.

Table 2: Encounters with Jupiter

Date	Time(UT)	Dist(RJ)	Dist(au)
03/25/1936	04:00	1145.9	0.5476
02/04/1972	12:00	1261.8	0.6030
05/27/2019	02:00	873.8	0.4175
11/11/2066	04:00	938.9	0.4487
12/06/2077	16:00	2009.7	0.9604

elements obtained were then used in Deep Space 3D to obtain the encounter distances. As this shows encounters with Jupiter in 2019 and 2066 will lower the perihelion distance to 1.16 au leading to several favourable returns in 2021,2049,2055,and 2089. This shall serve as a guide to future returns of this comet for potential observers within the limits of simulation error. The best returns of P/Borrelly occur in December,the worst ones in June.

Ray Badgerow



Telescope Makers

Attendance at the ATM's group has been lean at the last few meetings. Was this because of the holiday season or has everyone who wanted to make a telescope now completed a mirror? I am not sure of the answer to this question, but I know there is a lot more to making a telescope than polishing a mirror. A mirror to be of any use has to be mounted. This brings up further questions.

What is the best material to use? What kind of mount? Alt. Azimuth, Dobsonian, Equatorial? If Equatorial, what type? Fork, German, Poncet Platform, etc.? What about a drive? Clock, electric?

At upcoming meetings I would like to emphasize this aspect of telescope making as mounts can pose many problems. Our members have varied skills and I feel we can all help to make some fine instruments. We should also look at some of the newer techniques that many amateurs are using - electronic drives, computer drives, etc. One of our members is starting to build a C.C.D. telescope and has already assembled all the necessary bits and pieces. I look forward to seeing the results of this endeavour. Perhaps there are others who would be interested in such a project. Hoping to see more of you out at our ATM meetings.

Meetings are scheduled for February 20, March 6, and March 20, at Caledonia. If more information is needed call 765-4649.

Jim Winger

160 Renfrew St East
Caledonia, Ontario
N3W 1E9

Hamilton Amateur Junior Astronomers

The next HAJA meeting will be on Monday March 13th from 7:00 pm to 8:00 pm. The location is the usual room B148 by the planetarium in the Burke Science Building, McMaster University.

The topic will be "The Solar System and How it Works". (I will attempt to explain every phenomenon in the solar system!!! HAA, HAA, of course I'm kidding.) For information people can contact me at 577-6608.

Raechel Carson
Junior Group Co-Ordinator



Upward Skybound

The month for Valentine's has arrived. If the strain of mild weather keeps up, maybe sweethearts can be out enjoying the night winter sky. This is also the month of the elusive Zodiacal Light. The best time to look for it will be from Feb. 17 until the end of the month. It's a very subtle yet beautiful phenomenon. It appears like a cone coming up from the western horizon and tilting to the south. The base of the cone is some 20-30o along the horizon. The moon can easily fade the Zodiacal Light

out, so don't look for it then. Also start your search after the glow of twilight has completely faded. The zodiacal light results from sunlight scattering off dust particles lying in the plane of the ecliptic. It appears dim because our eyes intercept only a tiny fraction of this scattered light. You will also need a clear western and southern horizon with very dark skies. Hope you will see it!

February:
FQ Feb. 7 / FM Feb. 15 / LQ Feb. 22
March: NM Mar. 1 / FQ Mar. 9 / FM Mar. 17 / LQ Mar. 23 / NM Mar. 31

Venus: is brilliant in the low southeastern sky before dawn.

Mars: in western Leo, rises north of east at dusk. It is at opposition on March 12/95 and is the most unfavourable opposition since 1980.

Jupiter: rises about 3am. and is nearing the meridian as dawn begins. For most of the year Jupiter lies close to Antares of Scopus. As it will be low in the sky all year this is not a particularly good year of observation.

Saturn: is visible in the evening twilight early in the month, but soon will not be visible.

Workshops: Sat. Feb. 11/95 will be **Open Observing** at Binbrook Conservation Area in Binbrook. Call for the lock combination if you don't know it. **Jovial Satellites: Feb. 13/95 7:00pm, Room B148** The kid's will be learning how to use binoculars and simple star charts. If you have 7 X 35 binoculars that you would be willing to allow the kids to use (with proper instruction) I'd be grateful.. Weather permitting we'll take the kid's outside.

Sat. Mar. 11/95, 8:00pm "Meteorites" A video courtesy of the Gemini Gem and Mineral Club of Burlington. BYOB and goodies to **Ev's house**.

Clear Skies Above,
Ev Butterworth, Observing Director
632-0163

HAA Second Annual Star Party

Plans are being made for the HAA second annual star party!

Since the North York Astronomical Association is holding their Starfest at new moon in August and the South Simcoe Amateur Astronomers are having their Huronia Star Party at new moon in July, that pretty much leaves us with new moon in June.

Your star party committee/task-force (me) realizes that June is not a great time for observing because of the very short duration of darkness, but, hey, we play the hand we're given, right? Therefore, it has been suggested (after long hours of deliberation) that we hold this annual weekend event close to home. At this point, it looks like we'll be camping/observing at a group site in Valens Conservation Area. Stay tuned to your newsletter for further details. If anybody has suggestions, ideas, alternative sites, etc. in mind, PLEASE call me. This is YOUR star party - let's do it OUR way!

Which reminds me, we don't have a catchy name for our annual star party, yet. I know there are a lot of very creative minds out there so please send your suggestions to:

Ann Tekatch
19 Pheasant Place, Hamilton, ON
L9A 4Y4
phone: (905) 575-5433 (home)
fax: (905) 522-0064
e-mail:
a7503934@mcmaster.ca

The Cosmology Corner

Our last cosmology discussion group meeting held on January 14 was well attended. Some Hamilton Centre members were also present and very welcome to join in.

The topic for the evening was "LIFE" and while we found life has much to do with cosmology we could not decide what life is!

Talking about life; did you know that without spin, life would not exist? That brings me to our next topic "Orbits, Spin and What Makes the World Go Round".

Hope to see you at our next meeting March 18.

Bill Tekatch
575-5433

Huronia Star Party 1995

Those of us who attended last year's star party, held by the South Simcoe Amateur Astronomers, have all been notified now of this year's dates and times. Mark your calendars for July 27th to July 30, 1995. They plan to start informal activities Thursday night at 7:30 pm. Guest presentations will start Friday noon, July 28th. Farewell is Sunday morning, July 30th. This event is highly recommended. It is second only to Starfest, details of that event to follow as soon as we know them

Patricia Marsh

Off the Beaten Path

Well, we are now about two-thirds of the way through winter. Locally not much has been happening on the observing front, this past month. With over 15 days of solid cloud cover in January, I bet all of you are suffering from cabin fever. When the good weather arrives again, I encourage all of you to take a last look at Saturn before it sinks into the twilight later this month. In particular, take notice of the rings, because it will be the last time you will see them for over a year. When Saturn returns in May, the rings will be edge-on. This will give us an excellent opportunity to view the "ghost-ring" as described in the RASC Observers Handbook. The next time this opportunity will arrive will be in about 15 years.

This month also brings an opportunity to view various deep sky objects in the winter Milky Way. One of the richest areas to view is the Monocerotis region. The following is a list of easily located objects in this region and others, visible this month.

NGC 2244: This open cluster appears as a fuzzy star to the unaided eye. It is located slightly offset to the south west, about half way between 13 and Epsilon-Monocerotis.

NGC 2236/8/9: Known as the "Rosette Nebula", this wreath shaped cloud of gas surrounds the open cluster NGC 2244 in Monoceros. This is a difficult object to view unless you have dark skies, and a good nebula filter. Photographically it shows up well on any photograph of the area.

NGC 2261: This comet shaped, bright patch of nebulosity near S-Monocerotis, is part of a much larger, visually invisible nebula. It is known as "Hubble's Variable Nebula" because the star that powers it (R-Mon) is a variable star, thus the nebulosity varies in brightness as well.

NGC 2264: Called the "Christmas Tree Cluster" because of its distinctive shape, this 3.8th magnitude object is located around S-Monocerotis. It is quite a pretty sight.

NGC 2264: Located on the tip of the Christmas Tree Cluster (and shares it's designation), the "Cone Nebula" is a patch of dark nebulosity that is in the shape of a cone. To view this you need a dark sky and a good nebula filter.

NGC 1554/15: Located in Taurus around the famous variable star T-Tauri, "Hind's Variable Nebula" varies in brightness in a similar fashion as NGC2261.

NGC 3132: This is the challenge object for the month. This 8th magnitude planetary reaches no more than 4.5 degrees above the southern horizon at this latitude. Located roughly a degree north west of η -Velorum on the Antlia/Vela border, this planetary is one of the brightest in the sky.

Charles W. Baetsen
524-0148
charlesb@dogwood.physics.mcmaster.ca

CD ROMS & Software

Information on acquiring Space Images and Software

Currently various CD-ROMS and software are available that contain everything from Voyager 1 and 2 images, to Space Telescope images to images of the Comet collision with Jupiter.

Below are some of the major packages available and where to order them.

1. Hubble Space Telescope Guide Star Catalog CD-ROM Version 1.1 On 2 CD-ROM's, comes with Macintosh and

IBM software. Priced from \$99-\$149. Contact Virtual Reality Laboratories (805) 545-8515 or Astronomical Society of the Pacific \$59.95. Also Distant Sun's for Windows, Mac & Amiga contains the Guide Star Catalog and other info.

2. Electronic PictureBooks for the Macintosh. A Variety of Hypercard picturebooks ranging from "Gems of Hubble", \$19.95; "Images of Mars", \$19.95; "Magellan Highlights of Venus", \$19.95; and "Endeavor Views the Earth", \$39.95. All are various disk sets to be run on the Macintosh only (needs Hypercard). contact: Astronomical Society of the Pacific [a CD-ROM with all Picturebooks is now available]

3a. Assorted variety of Space and Earth related CD-ROMS. A wide spectrum of data ranging from Voyager, Magellan, Galileo, Clementine, Viking and Halley spacecraft data to name a few (very reasonably priced). Only on CD-ROM's. [NOTE: these images are raw & unprocessed images] contact: National Space Science Data Center

3b. Reaching the Stars and Beyond: "Images of NASA" Collection Over 375 images in GIF, Bitmap and ZSoft formats along with text (on CD-ROM), \$30 by WeMake CD's, Inc. Indianapolis, IN contact: CD-ROM Source (800) 346-CDCD Also try the following mail order companies: Pacific HiTech (801) 278-2042, and Educorp (800) 843-9497 for other space related CD-ROM's.

3c. Collection of images of the Comet impact with Jupiter Collection of images on CD-ROM of the recent Comet impact in GIF, PICT, Bitmap & text files. \$29.95 contact: Pacific HiTech (800) 765-8369

3d. Collection of images & data of the Earth Collection of images on CD-ROM of assorted satellite and spectral data of the Earth and its chronosphere along with political and geographical maps and almanacs. \$79.95 contact: Now What Software (800) 322-1954

4. Catalog of Government Scientific CD-ROM Titles. Catalog of Assorted CD-ROM's (very technical info). Note

this is just a catalog, you have to order from the source(s) listed for the CD-ROM. contact: PDS Operator at JPL

5. Assorted Scientific software (imaging, geology, etc) SciTech, "Software for Science" catalog, 1-800-622-3345 [DOS, Windows, Mac, Unix] Rockware, "Scientific Software" catalog, 1-800-775-6745 [DOS, Windows, Mac, CAD, Unix] Andromeda Software, PO Box 605-H, Amherst, NY 14226-0605 "Scientific Software" catalog [IBM & Commodore]

6. VideoDiscs Superb collection of Videodiscs titled "Space Disc", about \$300 Optical Data Corporation, 1-800-524-2481

Also look through the following magazines for additional software, etc: Earth, Astronomy, Sky & Telescope

Astronomical Society of the Pacific (ASP) 390 Ashton Ave, San Francisco, CA 94112 (415) 337-2624 (sk for their catalog also, contains a wide assortment of software, books, video's, slides, etc.)

National Space Science Data Center Code 633.4 Goddard Space Flight Center Greenbelt, MD 20771 phone: (301) 286-6695

PDS Operator
Mail Stop 525-3610
Jet Propulsion Laboratory (JPL)
4800 Oak Grove Drive
Pasadena, CA 91109
phone: (818) 306-6130

Mail Order companies for CD-ROMS (call for catalogs):

1. Pacific Hitech (800) 765-8369
2. Tiger Software (800) 238-4437
3. Most Significant Bits (800) 755-4619
4. Cambrix Publishing (800) 992-8781
5. Telecentral (800) 799-9917
6. CD-ROM Warehouse (800)237-6623
7. Crazy Bob's (800) 776-5865
8. JD Express (800) 409-0617

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This article came from the internet. If this helped you at all, let George Lewycky know.

The H.A.A. Telescope Buying Brochure

Editor's Address

Please submit all articles, thoughts, or ideas to this address:

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or via e-mail at:
marshp@dogwood.physics.mcmaster.ca

Deadline is March 1, 1995

Take Note ***

The general meeting for the month of April will be held on the **first** Friday of the month, **April 7, 1995**. The meeting date was changed due to the fact that the second Friday of this month is Good Friday. The time and place remain the same. Mark you calendars promptly.

Attached to the newsletter this month you will find a copy of our latest creation. I say "our" but it was completely and solely the hard work of one person, Stewart Attlesley. When reading the brochure, it is quite evident that Stewart spent many long hours on this project. Thanks Stewart!!!!

CALENDAR OF EVENTS

- ◆ Sat. February 11, 1995 8:00 pm **Observing Session-** Binbrook Conservation Area. Dress warm and bring your equipment out. (weather permitting). To be sure, please call Ev Butterworth at 632-0163
- ◆ Mon. February 13, 1995 7:00 pm **Jovial Satellites-** meeting at McMaster University Burke Science Building Rm. B148. Bring binoculars and warm clothing if it is a clear night.
- ◆ Fri. February 17, 1995 7:30 pm **Council meeting-** for information please contact Grant Dixon at 627-3683
- ◆ Sat. February 18, 1995 **Tidbit of Info-** 65th Anniversary (1930), Clyde Tombaugh's Discovery of Pluto
- ◆ Mon. February 20, 1995 7:30 pm **Amateur Telescope Makers Meeting-** at the home of Jim Winger in Caledonia. For further information and directions please call Jim at 765-4649
- ◆ Thur. March 2, 1995 8:00 pm **Royal Astronomical Society of Canada Hamilton Centre General Meeting** held at McMaster University Medical Building Rm 1A4. For more information please call Charles Baetsen at 524-0148
- ◆ Mon. March 6, 1995 7:30 pm **ATM meeting-** at the home of Jim Winger in Caledonia. for directions please call him at 765-4649
- ◆ Fri. March 10, 1995 7:30 pm **H.A.A. General Meeting-** held at the Spectator Auditorium. For more information please contact Grant Dixon at 627-3683
- ◆ Sat. March 11, 1995 8:00 pm **Video Night- "Meteorites"** to be held at the home of Ev Butterworth. BYOB For more information and directions, please call Ev at 632-0163
- ◆ Mon. March 13, 1995 7-8:00 pm **Junior Group Meeting-** McMaster University Burke Science Building Rm B148. Topic will be: The Solar System and How it Works. For more information please call Raechel Carson at 577-6608.
- ◆ Mon. March 13, 1995 **Tidbit of Info-** Percival Lowell's 140th Birthday (1855)
- ◆ Fri. March 17, 1995 7:30 pm **Council Meeting-** for information please call Grant Dixon at 627-3683
- ◆ Sat. March 18, 1995 8:00 pm **Cosmology Discussion Group-**McMaster University Burke Science Building Room B148. Topic of discussion is "Orbits, Spin, and What Makes the World Go Round". For more details, please call Bill Tekatch at 575-5433
- ◆ Mon. March 20, 1995 7:30 pm **ATM meeting-** in Caledonia. Topics will include telescope mounts. For information please call Jim at 765-4649
- ◆ Fri. April 7, 1995 7:30 pm **H.A.A. General Meeting-** *please note the change in dates. This is the first Friday of the month.* To be held at the Spectator Auditorium.