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President's Report

It would be fair to say that Astronomy can be a very frustrating hobby. The clouds, rain and fog, insect bites and frostbite, late nights endured and distances far to travel. Is it at all worthwhile?

Well, that one look at a distant galaxy, that one majestic photograph taken, or the explorations that delivers the "Ghost of Jupiter" to your eyepiece, yes folks, it is worthwhile. As time goes by it would seem that Astronomy is the best hobby and interest I could have ever hoped for. Take for instance lasts months general meeting.

The subject was "Cosmology" of which I knew little about. Our very own Bob Bee gave a very entertaining and enthusiastic talk. At the end of it I suddenly found myself with a new appreciation and understanding of this fascinating subject. Many thanks to Bob for a great talk

When I've been driving home from work the Venus and Jupiter show has been amazing. The pair were seen very close together on Monday night the 3rd of June at around 5.30pm. A really spectacular sight.

It happened recently.

Our journeys to the darkest depths of the forest have proven a most happy hunting ground for us stargazers. I'm speaking of course about the International House stay-over in the Belanglo State Forest. Dark skies can prevail and no doubt ice cold conditions will be endured. The night has been very anticipated but due to time constraints a report on the night cannot be made at time of writing.

The Observatory Public night was due to be held on the Saturday night just gone, too soon to publish comments but we hope as always for clear skies and smooth sailing.

It happens tonight.

Welcome to our June meeting in which we will be astounded by Astro-computing, Cosmology and maybe a hit on the head with a lump of space rock. Yes it's our discussion group time, so organised chaos will reign supreme!. Seriously many thanks go to Daniel, Ned and John. Maybe if time permits Peter Druery will give a quick update on the latest happenings and I might natter about telescopes in a discussion group.

Onward and Upward

I'm still in the process of organising our guest list of speakers and should have more information in the near future, but suffice to say plans are well under way.

Don't forget the upcoming night at The Seymour Centre. The speaker list is impressive and includes J.P.L scientist "Vicki Meadows" and the world renown "Seth Shostak" from the SETI Institute. The night is on Friday the 6th of July and starts at 6.30pm. The night is organised by The Australian Museum and the Australian Centre for Astrobiology.

We will return after a small absence to the Airfield for a double header being the 6th and 13th of July. Bring your woollies.

I'm signing off now

Noel Sharpe ■

Carbon Star Variables

In Greg Bryant's article about Crux in the May edition of Sky & Telescope, he drew attention to DY Crucis, a variable star just 2' west of β Crucis (Mimosa). It's a 9th magnitude carbon star, a star that can be truly described as 'red'. I took the opportunity to observe this star at the end of the public night on 18th May. This will now be added permanently to my show-and-tell list at public nights. It's not just red folks, it's a deep vermilion claret blood red. They don't get redder. Like a dying bar-b-q ember next to the bright floodlight of Mimosa, this star was an eye opener. And it seems there's plenty of them up there.

It caused me to dip into my reference books and the net to look up carbon stars. On the way, I discovered that in Ragbir Bhathal's book 'Australian Astronomers', there is a chapter devoted to Mt Stromlo's Jeremy Mould who's main forte was the study of carbon stars. Though there's not a lot elsewhere I could find written in layman's terms, there was enough to provide a rough understanding of where they fit in to the stellar life cycle.

Remember the mnemonic 'Oh Be A Fine Girl Kiss Me' (to give the sequence of star temperatures for Hot to cool - OBAFGKM). This was extended with RNS (Right Now Sweetheart) to allow for even cooler stars than the M class. Well, it seems the classes R and N have been combined into one newer group called type C stars or Carbon Stars. And also, the S class has been found to link with the carbon cycle as well. These are cool giant stars with a large abundance of carbon left over from their years of nuclear fusion. Almost always these stars can be seen quite easily in a star field by their sharp red colour.

The cause for this reddening is that the star's outside layers contain quantities of the carbon molecules C2 (CC), CN and CH which creates an absorption spectrum blocking out most blue wavelengths from the star's interior. It is also interesting to note that carbon stars are some of the few stars that are cool enough to permit molecular formation.

Observing these stars can be enjoyable. Each of these stars is a variable, usually with a long period extending well over 100 days. Their magnitude ranges can be anywhere between one and ten magnitudes which in itself can create a surprise if you're not used to seeing a star where one wasn't before!

To observe, use a wide field, low power eyepiece to start with. You can star hop to the location using a star atlas. Once you have aligned the telescope near or on the star, the star should just pop out at you as the reddest thing in the field of view. DY Crucis does. Use higher magnifications to get the field of view most pleasing to your eye, and enjoy the view.

The table below is a selection of carbon stars at declinations viewable from Sydney.

Star	RA (1950.0)	Dec (1950.0)	Mag.
RT CAP	20 14 11	-21 28.4	8.9-11.7
R CAP	20 08 30	-14 25.0	9.4-14.9
X SGE	20 02 53	+20 30.3	7.0-9.7
BF SGE	20 00 12	+20 57.0	10.3-12.1
BD VUL	20 35 10	+26 18.5	9.3-12.7
RS CYG	20 11 35	+38 34.6	6.5-9.5
U CYG	20 18 03	+47 44.2	5.9-12.1
V CYG	20 39 41	+47 57.8	7.7-13.9
RX PEG	21 54 03	+22 37.4	9.7-11.6
RV CYG	21 44 12	+37 47.3	10.8-12.4
TW PEG	22 01 43	+28 06.3	7.5-8.4
TX PSC	23 43 50	+03 12.6	4.79-5.20
AQ AND	00 24 53	+35 18.7	9.9-11.8
VX AND	00 17 15	+44 25.9	7.8-9.3
Z PSC	01 13 21	+25 30.3	8.8-10.1
V ARI	02 12 18	+12 00.4	9.8-10.8
Y PER	03 24 18	+44 00.2	8.1-11.3
R LEP	04 57 20	-14 52.8	5.5-11.7
W ORI	05 02 49	+01 06.6	8.2-12.4
α ORI	05 52 28	-07 24.0	0.0-1.3
BL ORI	06 22 37	+14 45.1	7.9-9.7
Y TAU	05 42 40	+20 40.6	6.50-9.2

Bob Bee ■

Stellar Tit-Bits

From various sources, I have found the following gems of astronomical discovery:

Most Massive Prize:

Within the well known Tarantula Nebula (30 Doradus) of the equally well known Large Magellanic Cloud, there is a dense star cluster called R136. The Hubble ST has taken some very beautiful pictures of it. Amongst the hot, massive stars of this cluster, astronomers have identified some new eclipsing binaries, and have accurately measured the mass, size and surface temperature of each of the components.

It came as a surprise that one of these binary components – named R136-38 was a type-O3 star with a mass of (wait for it) … 56.9 +/- 0.6 solar masses. This makes it the highest steller mass ever measured accurately.

It seems there are other stars whose mass has been estimated at greater than this. (eg Eta Carinae has been estimated at 100 solar masses, but this has been determined by inference and has a high degree of error.)

It gets even better. By measuring the binary's duration of eclipse and measured orbital velocity, they have calculated 38's diameter, and thus it's temperature. 48,500°K. That's seriously hot! To top it off, the two stars orbit each other in 3.4 days, at incredible speeds. I don't know about you, but I find masses, temperatures and orbital speeds like that very hard to imagine.

Cluster R136 in Tarantula

The stars in R136 are calculated to be only one million years old – babies!

Fastest Orbit Prize:

If you thought R136-38's orbital speed (3.4 days) was fast, tighten you seatbelt and I'll introduce you to the X-ray source RX J0806.3 +1527. Let's call it RX*.

RX* is in Cancer and astronomers have identified its optical source – a mag 21 blue star that exhibits the same fluctuation patterns as the X-ray source.

Using the very sophisticated instrumentation of the two 8.2 metre Very Large Telescopes of the European Southern Observatory, they have determined that the star is actually a binary comprising two white dwarfs orbiting each other only eight Earth diameters apart. (Read that last bit again – it was NOT a typo.)

And in case you wondered why you needed a seat belt… these two stars orbit each other at a speed of 1,000 km/sec **once every 5.4 minutes.**

Since the smaller of the two stars is 1.3 Earth diameters (and the other at least that big), that means they're only, at most, 6.5 Earth diameters apart, surface to surface, assuming a perfectly circular orbit, which is unlikely.

You've heard of extreme sports. Well, these must be extreme stars!

Aussie Astronomer Named:

When you read the popular journals *Sky & Telescope* and *Astronomy* etc, the breaking news stories are peppered with the names of astronomers from various observatories or universities (usually American or European) who have made the spectacular discoveries.

So it was a pleasant surprise to read in the June S&T an article about the unexpected discovery of a plume of dust from special Wolf-Rayet binary stars like the spray from a sprinkler nozzle. One of the principal astronomers involved was Peter Tuthill from University of Sydney, Australia (my old alma mater.) Onya, Peter.

Bob Bee ■

Time, Astronomy and the Quest for Longitude

John Casey

Last year we were given a great talk by Dick Everett, where he discussed his trip to England - including the Royal Observatory at Greenwich, and in particular the fabulous time pieces crafted by John Harrison that he saw there. John Harrison was a carpenter and self taught clock maker, who devoted his life to make an accurate chronometer for use at sea, in the hope of winning prize money detailed in the Longitude Act of July 8, 1714. He was a perfectionist, and would not submit his masterpieces for examination under the act until he thought them worthy- so he spent 40 years on his quest.

I have just read a book on the subject, titled "Longitude", by Dava Sobel, and found that the history behind this story was even more interesting than John Harrison's epic quest for perfection.
In the 18th century, "the longitude problem " was considered to be unsolvable and was the cause of huge loss of life at sea. Sea captains could determine their latitude at sea fairly easily - by measuring the length of the day, or the height of the sun or a known guide star above the horizon. Longitude required the exact measurement of time, both on the ship itself, and also at a home port or other place of known longitude. With the Earth rotating once in 24 hours, each hour difference represents $360/24 = 15^{\circ}$ of longitude. The captain or navigator could reset his ship's clock to local noon when the sun reached its highest point in the sky at that location and then consult his home port clock to see the discrepancy, with each hour difference representing 15°.

At the Equator, 15° of longitude represented 1,000 miles, so 1° is then 68 miles. North or South of the Equator this distance is shorter, reaching zero at the poles. Clocks of that period could gain or lose 15 minutes a day, due to variations in temperature, friction on the mechanisms, humidity changes, variations in barometric pressure, and the swaying of the ship. Thus, on a long ship journey in those days, the longitude was never known with any accuracy, so other methods had to be relied upon - such as "dead reckoning", where the instantaneous speed of the ship was measured by throwing overboard a heavy float, and measuring the rate that the line attached had to be let out. But note that time still had to be measured, and sea currents, waves and changing hull speed in the water between measurements all caused considerable errors to accumulate, and tacking into the wind, by introducing a zigzag course made things even worse.

Often, the 16th and 17th century captains detected their approach to a coastline better by observing flotsam than by their measurements of longitude. This was not surprising when their time pieces were initially half hour and hour sand glasses and later, primitive clocks, so it is appropriate to find that typical sailing instructions from Europe to the West Indies were summed up in the phrase "south till the butter melts, then due west". The introduction of clocks caused some improvement for shorter journeys, but for months at sea with errors of 15 minutes a day, landfalls could be out by hundreds of miles. By the end of the 17th century about 300 ships a year sailed between the British Isles and the West Indies, and merchants suffered crippling losses from even one ship lost at sea. The sailors were expendable.

Lines of latitude and longitude had been drawn on maps as far back as the third century before Christ. Ptolemy, in AD 150, used them on the 27 maps of his first world atlas. The spin of the Earth made it logical to choose the Equator as 0° of latitude, as the Sun, Moon and the planets all passed almost directly overhead at the Equator. The lines for the Tropic of Cancer in the North, and the Tropic of Capricorn in the South marked the noon time boundaries of the Sun's apparent motion in the sky over the course of a year.

There was no such "natural" boundary line for the 0° of longitude, so Ptolemy chose to run this line through the Fortunate Islands [now called the Canary Islands], off the west coast of Africa. Later map makers moved this primary meridian to suit the local politics and national prestige, so that corrections had to be applied by astronomers, based upon the time differences between the chosen primary meridians of these maps.

Christopher Columbus followed a straight path across the Atlantic ocean in 1492, using a compass and by keeping his latitude constant [as measured by the height of the sun and guide stars above the horizon], and continued on until he made landfall. This was a technique used by many of the master mariners of the time when heading predominantly east or west. Magnetic compasses came into general use from the 12th century, and by the 16th century, some good navigators could get a good idea of his longitude at sea by using his compass reading <u>and</u> sightings of the North Star. They were using the different North poles - the true and the magnetic poles, and charts showing how these differed for different longitudes and latitudes - but only for the regions where such data had already been determined. This magnetic variation method did not need an accurate clock on board, but needed very accurate compasses. It suffered from variations in local magnetic effects over time, and needed astronomers to make observations from islands in the area to get the needed data.

Renowned astronomers of the time attempted to solve the longitude problem by looking to the stars, planets and moons, with observatories in Paris, London and Berlin set up expressly to determine longitude by means of the heavens. Galileo Galilei, Cassini, Huygens, Newton, Halley, Hooke and many others were all involved in this quest, which gained in importance with increasing exploration and sea trading, and subsequent increasing loss of life from poor navigation. Galileo observed the moons of Jupiter for over a year and noted over 1,000 eclipses per year of these moons by Jupiter. He used these observations to create tables of each satellite's expected disappearance and reappearance, and submitted his scheme for determining longitude to the Spanish court in 1618. King Philip 111 rejected the idea on the grounds that sailors would be hard pressed even to see the satellites from their vessels at sea. They could not be seen in daylight, and would be visible for only part of the year, and only in very good weather, when the skies were clear.

Galileo designed a special navigation helmet based on his ideas, a "celatone" helmet worn by the observer, with a telescope to one eye hole, and a hole to observe Jupiter itself by the other naked eye. Testing showed that even on land, the pounding of one's heart could cause the whole of Jupiter to jump out of view in the telescope. His method was not applicable at sea, but was used after 1650 on land to help make accurate maps of the world. Further work done by the Danish astronomer Ole Roemer in 1676, showed that the eclipses of all four Jovian satellites would occur ahead of schedule when the Earth was closest to Jupiter, and fall behind schedule by several minutes when the Earth was farthest away. He concluded that this was because light has a finite velocity, and calculated the velocity of light. He slightly underestimated the accepted value of 300,000 kms per second used today, but was the first to make such a measurement.

The famed British Parliaments Longitude Act of 1714 was the result of a major shipping disaster. After the British fleet gained victory over the French Mediterranean fleet near Gibraltar, the fleet returned to England in heavy autumn overcast. The Admiral of the fleet, Sir Clowdisley, was worried about the poor visibility so he summoned all his navigators to fix their position. The consensus was that the fleet was safely west of Ile d'Ouessant on the Brittany peninsula. They continued north east, but had misgauged their longitude, and they were near the Scilly Isles, 20 miles off the southwest tip of England.

On that foggy night of October 22, 1707, four of the five ships hit the rocks there and sank. Of those on board these four doomed ships, 2,000 drowned, and only two survived - one was Sir Clowdisley. The previous day, one of the crew on the ship Association had told his captain, Admiral Shovell that by that sailor's own reckoning during the passage, the navigators had grossly miscalculated the longitude. This questioning of the navigation of his superiors was forbidden within the Royal Navy, so the man was hanged for mutiny on the spot.

This huge loss of life, following so many other such incidents caused shipping interests in London to unite to petition Parliament for a solution for the longitude problem. In May 1714 a Parliamentary committee sought expert advise from Sir Isaac Newton, then aged 72, and from Edmund Halley, who had mapped stars in the southern hemisphere and measured magnetic variation over the vast regions of his travelling.

Newton summarised the existing means of determining longitude - by exact time keeping from clocks, exact time keeping from celestial events, such as eclipses of Jupiter's satellites, predicted disappearances of [known position] stars behind the Moon, the precise timed periods of lunar and solar eclipses, and angle measurements between the Moon and the Sun by day or the Moon and known position stars at night. None of these [at the time] could provide sufficient accuracy to give certainty to mariners at sea, although some could fix position on land with adequate instruments.

The actual Longitude Act was issued in the reign of Queen Anne, on July 8, 1714, and offered prize money as follows-
10,000 pounds for a method to determine longitude to an accuracy of one degree;
15,000 pounds for a method accurate to two thirds of a degree;
20,000 pounds for a method accurate to half a degree.

The fact that the huge amount of 20,000 pounds was being offered for a method that fixed position at sea to an accuracy of within 34 miles longitude at the Equator showed that these were desperate times. The act set up a panel of judges known as the Board of Longitude, consisting of scientists, naval officers and government officials to exercise sole discretion over the distribution of prize money, and they could give incentive awards to help inventors bring their ideas to fruition. By the time the Board of Longitude was disbanded in 1828, it had disbursed over 100,000 pounds to inventors.
This was the world's first known government sponsored research and development funding. To win the prize, and achieve an accuracy of $1/2^{\circ}$ in longitude for a six week voyage from England to the Caribbean, the time piece must be accurate to 2 minutes over the whole journey. That's an error of less than three seconds per day, when the shore based clocks of the day had errors of about 15 minutes per day.

To judge the actual accuracy of any proposal, the chosen technique had to be tested on one of "Her Majesty's ships as it sails over the ocean, from Great Britain to any such Port in the West Indies as those Commissioners Choose.... without losing their Longitude beyond the limits before mentioned."

As early as 1514, the German astronomer Johannes Werner sought to use the motion of the Moon through the heavens as a location finder, as the Moon travelled a distance through the heavens about equal to its diameter each hour. In the day, the Sun-Moon distance could be used, and at night, the Moon would trace a path across the stars which would be different for each location and time and date. The method required exact location of the stars [and of the Moon] and these were not well known at the time. So one of the outcomes of the longitude problem was that observatories were set up in Paris, Berlin and London to start compiling this data. King Charles 11 set up the Greenwich Observatory, with John Flamsteed as Astronomer Royal, to apply "the most exact Care and Diligence to rectifying the Tables of the Motions of the Heavens, and the Places of the fixed Stars, so as to find out the so - much desired Longitude at Sea, for perfecting the art of Navigation."

Flamsteed began working at the new observatory in October 1676 and toiled for four decades on these observations. The star catalogue was published posthumously in 1725. By then, Sir Isaac Newton had produced his theory of gravitation, and the orbits of the Moon and planets were beginning to be understood. In 1637 Galileo described his ideas of using a pendulum to regulate the workings of a clock, but he never proceeded, although his son, Vincenzio did construct one from his drawings.

The gifted astronomer, Christiaan Huygens, who discovered Saturn's largest moon, Titan, built a pendulum regulated clock in 1656, and by 1660 had made two marine timepieces which he tested on board ships. On the third trial, in 1664, his clocks sailed to Cape Verde Islands, off the coast of Africa, and kept good track of the longitude all the way there and back. However, further trials showed that they kept time only in fair weather, and in heavy seas the pendulums swung abnormally. He then invented the spiral balance spring as an alternative to the pendulum in controlling the clock's rate, but the errors were still too large, and varied unpredictably.

By 1721 Newton noted the improving precision of clocks, but pointed out that if the Longitude at sea is lost, it cannot be found again by any watch. He concluded that celestial observations remained the most promising route to Longitude. He died in 1727, and it would take another four decades before the Longitude prize was [partially] won.

Amongst the many who sought the prize money was a Jeremy Thacker, who called his device a Chronometer. It had new developments - the clock mechanism was within a glass faced vacuum chamber to protect it from changing atmospheric pressure and humidity; a set of cleverly paired winding rods that kept the clock going normally as it was being wound up; and the whole machine was suspended on gimbals, like a modern ship's compass, so that it maintained its station on a storm- tossed ship. His clock did not meet the standard required because of the influence of temperature, which caused expansion and changing spring tensions - and these caused errors of as much as 6 seconds per day.

Then a carpenter called John Harrison came onto the scene.

John Casey ■

Frozen water detected on Mars

NASA's Mars Odyssey spacecraft has reportedly detected water ice under the surface of the red planet - offering the possibility for the first time of sustaining human life on Earth's nearest neighbour.

Many astronomers believe Mars used to have quantities of liquid water on its surface, but they've never agreed on where the water went. Liquid water is seen as a prerequisite for Earth-type life on a planet, and underground water ice could be a key to understanding how Mars developed. The detection of sub-surface water ice on Mars is just what Mars Odyssey was sent into space to investigate.

The head of NASA's Mars exploration program, Jim Garvin, has told a conference of planetary scientists in Washington that NASA plans to put a man on Mars within 20 years.

Mars Society Australia president Guy Murphy today said research being conducted by Australian scientists into sustaining life on Mars would

make a "modest contribution" to NASA's plans. The society was building a capsule in the Australian outback to simulate life on Mars, including how to find water, transportation requirements and surface conditions.
He said this information, together with sister projects in North America and Iceland, would fill a gap in the official NASA research.
"It will contribute to the knowledge base that's going to be required to undertake that exercise," he said.
"It will be a modest contribution but I think it's something that many Australians will be pleased to see Australia become involved in."

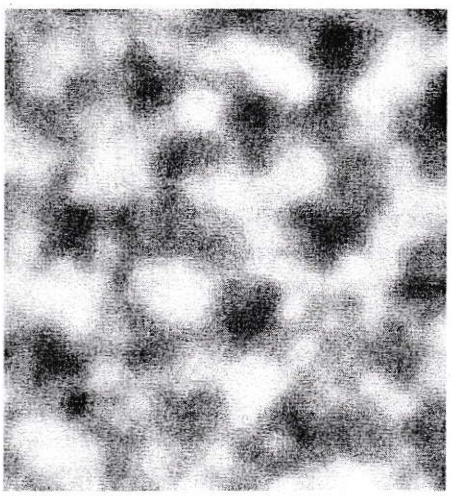
The discovery of water on the red planet has boosted hopes of sending a manned mission to Mars sooner than planned. Without a ready supply of water, human missions would need enough on their spacecraft to last the two-year round trip - both logistically difficult and expensive.

Dr Nick Hoffman, a senior lecturer in earth sciences at Melbourne University and a member of the Australian research team, said the outback was perfect for Mars research. The society recently confirmed the research would be conducted at Lake Frome Plains, east of Arkaroola in South Australia, because of its similarity to parts of Mars.

Bob Bee ■

Big Bang background radiation

Astronomers on opposite sides of the world yesterday announced results from two experiments studying the cosmic microwave background radiation, the remnant radiation from the Big Bang. These results reinforce the scenario that cosmologists have compiled over the last few years: we live in a flat (Euclidean) universe filled mostly with exotic dark matter and dark energy. It also supports the theory that the Universe experienced a moment of extreme inflation in the first split (10^{-32}) second of its existence.



(Image of the CBR)

Many groups have been racing to map the weak microwave glow that fills the sky, using super-sensitive instruments on spacecraft, balloons, high mountains. The microwave glow is a picture of the cosmos as it stood about 300,000 years after the Big Bang, when the cooling universe was still filled with white-hot gas that was just becoming transparent to its own radiation. This was in fact the 'last scattering surface' of the primordial fireball, with a temperature of 4,000°K. This temperature has cooled further with expansion and Doppler shift, to result in the temperature of 2.725°K measured today

.

The gas was spread through space extremely smoothly — but not perfectly so. Imprinted in it were very slight irregularities that stemmed from the earliest moment of the Big Bang. These went on to grow into the galaxy clusters we see today. The sizes and strengths of the irregularities tell volumes about the universe's origin and contents.

It is these extremely precise measurements of the fluctuations of the background radiation that will deliver support or the death blow to contesting cosmology theories, the Inflationary Theory and the very recently announced Cyclic Universe (Brane) Theory.

It still beggars my mind that, with super sophisticated instruments, scientists can actually produce an image (admittedly not in the visual wavelengths) of what the Universe actually 'looked like' only 300,000 years after the beginning of the Universe. Yet we still can't find a vaccine for the common cold.

Bob Bee ■

What IC This Month
June 17 – July 14, 2002

Diary

Mercury meets with Saturn;
Penumbral eclipse of Moon;
Jupiter leaves evening sky;
21/6 Earth at Winter Solstice;
6/7 Earth furthest from Sun (152,000,000 km)

Evening Sky Planets

Mars starts the month in Gemini and moves to Cancer in July. It can only be seen in the twilight very close to the Sun now. On 30/6 it will be less than 2° below Jupiter if you have a good western horizon. Setting just one hour after the Sun, between 2-5 July it will be very close to Jupiter but only 3° above the horizon. Mid July will find Mars in the Sun's glare until it returns to the morning sky in September.

Jupiter is also in Gemini and will overtake Mars into the Sunset. It will be behind the Sun until rising in the morning sky mid August.

While everything else sinks into the sunset, **Venus** is rising higher in the evening sky each night. Starting the month in Gemini it will slip 4° by the Beehive cluster in Cancer on 21/6 and leap into Leo. Between 8-13/7 it will show up just 3° from Regulus.

Uranus and Neptune will rise mid evening. Uranus has moved into Aquarius while Neptune is still in Capricornus. On 28/6 the moon will approach Neptune after midnight. Both planets will brighten in August

Morning Sky

Mercury rises in Taurus and will be near Aldebaran on 23 - 24/6. It will move to within 4° of Saturn at the end of June when moving back to the Sunrise.

Saturn will be in the sunrise during June, but will rise in Taurus by early July. On 3/7 it will jostle Mercury and on 9/7 the Moon, before the Sun gets up. By mid-July Saturn will rise about 5.30 am

Moon Events

18/6	1st Qtr
25/6	Full Moon
3/7	Last Qtr
10/7	New Moon

Technically the penumbral eclipse on 25/6 will cast a slight shadow on the Moon at 7.25 am. Practically it will probably be invisible.

Comets

7P/Pons Winnecke will move from Aquarius to Sculptor during June. Then in early July it will rise before midnight at 11.0 mag. Look for it between NGC 55 and 300.

46P/Wirtanen at 11.0 mag will pass across the face of the Hyades in Taurus about mid July.

Sky Portraits

Our constellations this month are in a line from the Ecliptic going to the north. First there is :-

Libra – The Scales

or "Balance", so named because some four thousand years ago, the sun passed through this constellation at the autumnal equinox and the hours of daylight and darkness were equal. As a symbol for equality, the constellation came to represent Justice in several cultures.

However, the Greeks had included it as part of Scorpius, which lies just to the east. The stars that make up Libra were the Claws of the Scorpion.

The Greeks also linked the ideas of equinoctial division and agriculture in another story that gives us the constellation's other name 'The Golden Chariot of Pluto'.

The ruler of the Underworld was named Pluto (aka Hades) who was a brother of Zeus and of Poseidon. Pluto's Golden Chariot was used whenever he wished to visit the Upperworld.

Deep beneath the earth, he owned all its mineral riches. He was usually ignorant of the happenings of the Upper world, only emerging from his dark kingdom to seduce beautiful nymphs. While these relationships did not last, all changed when he saw

Persephone, the daughter of Demeter and Zeus. Demeter was the sister of Zeus and Pluto, and one of the most important goddesses, responsible for agriculture and all growing things.

Pluto captured by the beauty of Persephone, wants her for his own and abducted her by force down to his kingdom, where she became Queen of the Underworld.

Demeter distraught about the loss of her daughter forbids any seeds from sprouting. A vast drought spread throughout the Upperworld. Zeus became vexed, because his food offerings had dried up, so he forces his brother Pluto to give up Persephone, so that the Upperworld could again become green and lush. If Persephone hasn't eaten anything since her arrival Pluto says, he will agree. Alas, she has consumed six pomegranate seeds, so Pluto claims she cannot return.

Zeus becomes angry and rules that she must divide her time between the Upper and the Underworld. Thus every year the earth becomes a cold and forbidding place, until Persephone is allowed to emerge from the Underworld, bringing Spring with her.

The stars in Libra are fairly dim, except for 2nd mag. stars alpha2 and beta. There are some fine double stars.

Double Stars

Alpha2 and alpha1 Librae also known as Zubenelgenubi, meaning "Southern Claw", form a very wide double 2.9, 5.3; with colour contrast of yellow and pale blue, separation 231".
Beta Librae is not a double but is called Zubeneschamali, "The Northern Claw". Some have described this white star as green.

Iota Librae is a multiple system: ***Iota1A*** is a rapid binary with a period of 22 years, travelling in a retrograde motion. ***Iota1B*** is a fixed wide companion: 4.5, 9.5, sep 58.6".
Struve 1962 is a fixed pair of equal stars: 6.5, 6.6, sep 11.9".

The only deep sky object in Libra is a loose globular cluster of faint stars - **NGC 5897**, 2° southeast of *Iota Librae*, thought to be about 50,000 light years away. A large telescope will give a better impression.

Directly north from Libra we find our second portrait - The Serpent.

Serpens is being grasped in the hands of Ophiuchus the Serpent Holder. The constellation wraps around Ophiuchus, and is divided into two parts: Serpens Caput (the head), to the west, and Serpens Cauda (the tail).

The constellation is large but has few features of interest. There are a couple of spectacularly good Messier objects and some very nice binaries. The brightest star, **Alpha Serpentis,** is called Unukalhai, meaning "Neck of the Snake". At mag. 2.7 and 67 light years away, it is approximately ten times the size of our Sun.

Double stars:

Serpens has three visual binaries, two of which are very attractive, and one that will test your observing skills.
Beta Serpentis (Struve 1970) is a wide double difficult to observe due to the brightness difference of the faint companion: 3.0, 9.2, separation 30.8".
Theta Serpentis (Struve 2417) is a wonderful binary of two white stars: 4.0, 4.2, sep. 22.2".
Struve 2375 is a superb pair: 6.2, 6.6, sep 2.4".

Deep Sky Objects:

There are two Messier objects in Serpens: M5 and M16; the first is found in the "head" of the serpent, the second in the "tail".

M5 (NGC 5904) is a spectacular globular cluster, containing half a million stars. The cluster is quite compact and rather bright; it is about 25,000 light years away, and ten billion years old. The cluster is found 8° SW of alpha Serpentis.

M16 (NGC 6611), "The Eagle Nebula", is a remarkable open star cluster surrounded by a huge nebula, very luminous with dark streaks of dust. Best seen in large scopes with a nebula filter the cluster is 15° south of *Eta Serpentis*, but an easier way is to star hop two and half degrees north from M17 The Omega (or Swan) Nebula, in Sagittarius.

Continuing further north we come to our third constellation which is a half circle of stars called –
Corona Borealis, or the Northern Crown. This is the crown of Ariadne the daughter of Minos, king of Crete, which she wore at her wedding. The story is connected to a very complex myth of Theseus and the Minotaur.

Every year Minos ordered a tribute of seven young men and seven maidens sent from Athens to be served up to the flesh eating Minotaur.
When it came time for the yearly tribute to Crete, the son of Poseidon, and heir to the Athenian throne Theseus, volunteered himself to be one of the seven young men. Already acclaimed as a hero in his home town what else could he do!

Arriving in Crete, Theseus was challenged by Minos to prove he really was the son of Poseidon by retrieving a gold ring that he immediately cast into the sea. Diving into the water Theseus grabbed the ring but was met by dolphins before he could return to the surface. He was escorted to the palace of the Nereids, where one of the Nereid sisters (or sea nymphs) gave him a jewelled crown made by Hephaestus, the supreme goldsmith, in his underwater smithy.

With the gold ring and the crown, Theseus returned to Minos the king. This feat got him introduced to Ariadne who fell in love with him immediately. She promised to help Theseus kill the Minotaur if he would marry her and take her back to Athens. Theseus agreed, so she gave him a magic ball of twine that could roll out by itself and lead him out from the centre of the labyrinth, where the Minotaur was kept.

When sent into the labyrinth Theseus promptly killed the Minotaur and followed the rolling twine safely out again to marry Ariadne and give her the jewelled crown as a wedding present.

However on the way to Athens he abandoned her at the isle of Naxos. Not a very heroic character after all. Dionysus was visiting Naxos, and falls in love with the lovely Ariadne and takes her for his bride with the jewelled crown of Hephaestus on her head. They raised four sons and `lived happily ever after'. When Ariadne died Dionysus took the wedding crown and placed it in the heavens between Hercules and Bootes.

The constellation is found nearly midway between Arcturus and Vega, north from Serpens Caput. From Arcturus move down to Izar (Epsilon Bootis) and then east 15° to **Alpha CrB**.

The seven stars that make up the crown are not bright, except for Alphecca (or Gemma) ***Alpha Coronae Borealis***, which is a 2.2 magnitude star 75 light years away. The other stars vary from three to six magnitude.

Double stars in CrB.
Eta CrB (Struve 1937) is a fine binary with orbit of 41.5 years and separation 0.9".
Zeta2 and Zeta1 CrB (Struve 1965) are a pleasant pair of blue-white stars with 5.0 and 6.0 mag. separation 6.3".
Sigma CrB (Struve 2032) is a slow binary, with a period of a thousand years. Separation of the companion is 7.03".
Nu1, Nu2 CrB (Struve I 29) form a very wide unrelated pair of orange giants separated at 372". Quite suitable for binoculars.

Scales, chariots, snakes and crowns; all are placed for your enjoyment like portraits in the sky.
Good seeing IC

And now for a different star –
Jadzia Dax – Deep Space 9

BLACK HOLE NO 4

This is the third in a series introducing types of Black Holes.

A new class of black holes called **Mid Mass Black Holes** with masses ranging between 100 and 100,000 times our Sun, has been detected using the Chandra X-ray space observatory. For the last twenty years astronomers have been puzzled by unusual X-ray glows from within many galaxies. With the discovery of quasars and central Super Massive Black Holes much of the mystery seemed to be solved.

However some galaxies lack a bright core nucleus, like our own Milky Way, and the type of X-rays coming out do not fit the theory. They have the same X-ray variability of Super Massive Black Holes but look more like Stellar Black Holes, only brighter.

It was first thought they were old, lazy or less active black holes consuming matter at a slow rate, but now it is understood they are smaller versions of SMBH swallowing gas and dust faster and more efficiently, shining brighter than stellar BH, but not as bright as galactic SMBH.

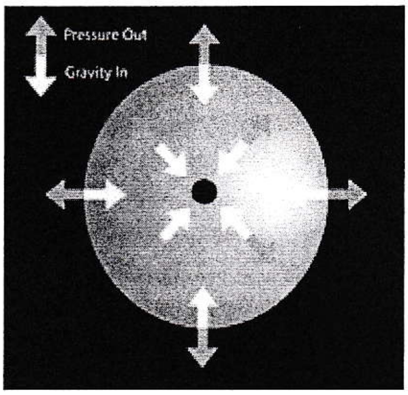
The amount of X-rays coming from the event horizon as matter crosses over, seems to have more to do with the internal mass of the black hole rather than the brightness or luminosity of that matter.

This type of black hole with masses of 10,000 to 100,000 times our Sun could explain the bright emission low luminosity of Seyfert type galaxies with very active cores.

Just such a **MMBH** (Mid Mass Black Hole) has been confirmed at the centre of NGC4395 in Canes Venatici, 7.5° from the star cluster forming the hair of Coma Berenices.

Because they reside in very small galaxies and are hard to find, this was thought to be the only one of its type. However with the detection of other **MMBH** covering a wide range of masses, it is now thought they are more common and not always located at the centre of galaxies

A further smaller type of MMBH with 500 times the mass of the Sun and some peculiar characteristics, has been found in M82 in Ursa Major.



12 million ly away the black hole has a very low gravitational pull on the surrounding matter. If it was any weaker the X-ray blast outwards from the event horizon could possibly blow the incoming gas backwards. The black hole would stop radiating X-rays and quietly disappear from view.

Mid Mass Black Holes are just smaller examples of the big galactic ones located in different places and with different habits. They range in mass from 100 – 10,000 for the small type and up to 100,000 times the Sun for the large end of the category.

The smaller ones could have come from a collapsing 'hyper star' producing a larger black hole than expected, or the merging of several small black holes. Larger ones may have grown from a small black hole sucking up a surrounding cloud of gas. These questions are only now being worked on

Next article - Strange Black Holes

Ian Cook

At a Glance up to September.

17/06/02	General Meeting
06/07/02	The Oaks
13/07/02	The Oaks
15/07/02	General Meeting
10/08/02	The Oaks
17/08/02	Obs. Public Night
19/08/02	General Meeting
07/09/02	Dark Site Belanglo
14/09/02	The Oaks
16/09/02	General Meeting