MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal

PRIME FOCUS

Volume 10 Issue 2 March 2005

President's Report

Greetings to all members and guests.
Sorry I can't be here tonight as I am currently enjoying a much awaited holiday down the South Coast. It's been a very busy period for me personally with little time to enjoy my hobby of astronomy. Summer is not that conducive for stargazing with it not getting dark until late and cloudy weather in abundance. Recently though we had a great night down at The Oaks and from what I heard some members we going strong into the wee small hours.

Last Month

Our guest speaker was Peter Elston who spoke to us about flying his Jumbo jet down to Antarctica and chasing a Solar Eclipse. It was a great talk featuring interviews with the eclipse chasers, footage of the event and lots of stories to be told. Later that week Peter said how much he enjoyed his time with us. I am sure our paths will cross again. Thanks Peter.

Very Important

Our Annual General Meeting will be held next month on the 18th of April, nomination forms are available near the sign on book. All nominations for positions must be received by the secretary no later than the Monday the 4th of April.

Membership fees are definitely due and we would like to see everyone being very timely with this. Our thanks to all the members who have renewed last month, well done.

Lots of Activities

At time of writing we are heading down for our first forest night this year. Looks like clear and dark skies await. Also John Rombi will bring us up to date around the Catholic high school teachers star night held near Bowral last Tuesday. Also the first Campbelltown Rotary Observatory night was held Friday just gone, maybe someone can do a wrap up of that event and Bob Bee has been involved with

his talks out at the Mt Annan Botanical Gardens. Last one was on Friday the 18th of March. What a busy month!

Plenty to Talk About

As an idea for tonight's meeting we thought we would hold a series of conversations, at time of writing we are looking for facilitators to lead the following topics.

What I learned about astronomy from the internet
What I learned about Astrophotography
I am interested in the astronomical subject of....

It's planned to be a casual night and should be very enjoyable. Next month after the formalities of the AGM we might have a video presentation. We have compiled a list of speakers that we will be contacting over the next few months and I will keep you posted when confirmations are available.

Some Ideas

We have an idea to purchase an audio visual unit for our club. This would be a great asset as we can show DVDs and videos, have power point presentations etc. Our guest speakers could use it as well. It really is a valuable tool and would enhance our meetings greatly.

We have over the years been quite responsible with our finances and maybe its time to make a purchase that would benefit everyone. I have raised this because it is a major expense and it's only fair to raise it for discussion.

Also we are thinking about a stay overnight at the Magellan Observatory near Goulburn, I am in the process of asking Zane Hammond who runs the observatory to come up and give us a talk. Zane spoke to us a few years back now and is an amateur astronomer and photographer in his own right. The Magellan Observatory visit is also a farm stay with plenty of things to do, there is also a large 18 inch scope on site. Details when they come to hand

Revised Dates

02/04/05 The Oaks
06/04/05 Mount Carmel High School
09/04/05 The Forest (needs confirming)
18/04/05 Annual General Meeting
30/04/05 The Oaks
07/05/05 TBA
14/05/05 Possible Public Night, Dudley Chesham Sports ground.

Already we have had to make a few changes as opportunities arise and dates shift around a bit, it's very important before heading to double check as I would hate to inconvience anyone with a late change. For example we are trying to slot in the Magellan night and a relocate of an observing night out at The Oaks. So please check in with John Rombi or myself on 0410 445 041,

Well that's all from me. Hope you have a great meeting tonight and I will be thinking of you when having that cold beer down at the Sussex Inlet RSL.

Noel Sharpe
President

Mystery of the Night

John Casey

It's a weekend, warm during the day, with a bit of cloud and also smoke haze from the burn offs in preparation of the fire season - but a southerly came up in the afternoon making it colder and blowing away the clouds and smoke. As night comes on the wind drops, and the sky darkens. A walk outside after dinner- it is pitch black and the stars are out. No moon tonight, and hardly any twinkling of the very bright stars- the Southerly blew away the dust smoke and haze, cooled down the land, and now, at last, an unusual event for Campbelltown - a good seeing night!

Time to dust off the reflector and doing some viewing! So clear and dark even the small Magellanic Cloud stands out. Exceptional!! Come on out love, I have set up the telescope and you will be amazed at what you can see! Wait till *Home and Away* finishes?!! Some people just cannot see what is worth thinking about!

Ahh, at last you are here. Yes it is very dark now. But what did you say? Why is the sky dark at night?!!! Anyone, everybody knows! The Sun has set, and the moon is not in view to reflect Sunlight at us.....Uhhm. What am I looking at? Stars of course! How many are there? Lots! Billions and billions of them... Why are some brighter than others? Mainly because the dim ones are further away, but some are brighter than the Sun, and others are dimmer... Yes, if I had a bigger telescope, I could collect more light and see dimmer and dimmer stars... Oh yes, I was meaning to talk to you about that. There are some beauties in the latest issue of Sky and Space... Dream on???? Well, maybe next year we can afford it... Yes, because they are further away.... Well, when the individual stars are so far away that we cannot see their light alone, we see them in clusters of billions in the form of galaxies... Yes, and there are so many galaxies out there that no matter where you point the telescope you fill you view with them...

What! You already asked me that! Why is the sky dark at night! Are you a cosmologist or something? Just stop asking silly questions and let me enjoy the view... there are not many good viewing nights around Campbelltown nowadays!!!

Well, it may sound like a trivial question, but it is not, and this question had been asked and discussed for hundreds of years. And in very good company too! Professor Sir Hermann Bondi discussed this issue as one of the lectures of the 22nd International Science School at Sydney University, in 1983. Some of the information for this article was provided by the publication "Science Update" which documented these lectures. The question was first asked and documented by a French doctor by the name of Che'sieux in 1744, but made famous as a paradox by the German astronomer Olbers in 1826.

Olbers pointed out that that on a clear night we can see many stars, but some are very bright, many more are just bright, and there are vast numbers that look very faint. He suggested that these properties could be accounted for by the fainter stars being further away, not just by being dimmer stars. Olbers made the assumption that the universe is uniform, so that the density of stars, and their luminosity far away is similar

to those closer to us, and that the universe is unchanging, so that long ago things were pretty well the same as they are now. Thus the fainter stars were farther away, light took longer to reach us, so we looked back into the past as we look at fainter stars, so their density of stars would be similar to those nearer to us. He also made the reasonable assumption that the laws of physics far away and long ago were the same as apply to us now.

Olbers then wondered what was the totality of **all** the light that we should be receiving from **all** the stars. He knew that distant stars would be faint, but there would be billions of them, so although individual stars would be too dim to see, there should be a kind of background glow in the sky from all the light they contributed. He attempted to calculate how bright the sky should be.

He calculated that looking at slices of spherical shells of space of radius r from us [with only a small thickness d(r) between concentric shells] would contain stars in proportion to the square of the radius of this sphere. But the light intensity of each star at that same radius diminishes as the square of radius from us. Thus each shell, being further from us, but with the same shell depth d(r), will have the decreasing light contributed by each star exactly compensated for by the increasing number of stars in that bigger volume shell, so that each shell will contribute the same amount of light at our location.

As the universe is considered infinite, there are an infinite number of these shells contributing light, so we should be blinded by the light of the stars. This was Olbers paradox, and at the time no one knew why this was so. The answer to this paradox only came in the 1920s when Hubble found that the universe was expanding.

Olbers had made another [implied] assumption, although he did not know it at that time - and this turned out to be critical - that all stars, on average, were at rest relative to us and to each other. There was another minor point - stars had size, and those in front could obstruct the light of those behind. When this factor is introduced, the totality of light was no longer infinite. However, using Olbers assumptions and this correction, the light of starlight should 40,000 times as bright as the sunlight we get from the Sun in daytime, and this light would come at us day and night!

Olbers was struck by this paradoxical result and offered a possible explanation. He suggested that the universe may not be completely transparent. However, this argument was wrong, as whatever obstructs the light would absorb it, and in doing so, over time, get hotter. This would continue until that obstruction was also radiating light of the same intensity. When that happened, there would be no obstruction.

How do we get out of this paradox? One way is to suggest that the universe is so young, that no approach to equilibrium temperatures would have been reached yet, so some parts are cold and others hot, but the cold regions are getting hotter, and hot ones are cooling. Another is to say that the universe has both sources and sinks of radiation. The sources were the nuclear furnaces in the heart of each star - but where are the sinks? In thermodynamics it is well known that work can only be done if there is a difference in temperature - you burn fuel to make hot gases out of cold gases, these expand, push the pistons in your car, the motor does work,

and you fly up the hill, but only when you can get rid of the hot gases into a colder environment. If the temperature everywhere was the same, then **no** motors would work. Only by maintaining the temperature difference between the hot and cold sides can a power station make power. The bigger this temperature difference, the more power can be generated. So to get rid of this heat from the stars we need a **big** heat sink.

But instead of a glowing night sky we see blackness, implying a very low temperature for the average radiation from the universe. How can this occur? Well one way is for the universe to expand and in doing so do work, and get colder. Olbers had assumed that unchanging uniformity and the assumption that the universe was unchanging together would mean that there can be no net motion at all. But uniform expansion does not violate Olbers' assumption of unchanging uniformity if all points in the universe move away from each other at a similar rate.

But this expansion does do one thing - it acts as a sink for energy. Energy that otherwise would have warmed up all matter in the universe would have been drawn off doing work in expanding the universe. This would show as loss of energy in electromagnetic radiation, and this would manifest as a lowering of the frequency of all radiation – i.e. in a red shift. Think about pumping up you car tyres by hand pump. You do work and compress the air in the pump, it compresses and gets hot. You let air out of your tyres, it expands, and gets colder. The universe is just the same, only a little bigger.

One way of thinking about the universe without a heat sink is to think about the nuclear reactions in the centre of the Sun. These are going on at temperature around 25 million degrees. But the surface of the Sun is radiating this energy away into space at only 6000° Kelvin. If the sun was in a thermos flask, where no heat could escape, then the surface should also be at 25 million degrees. The surface of the Sun can only hold this lower temperature by being able to radiate energy away to cooler places. If they too warmed up, then so would the surface of the Sun. So the Sun would expand and become less dense, and the nuclear reactions would fade away enough to just maintain this 25 million degrees. The whole universe would warm up from other stars also expanding and warming, until all planets evaporate. So a universe without the dark is a hostile place!

Well, what about the temperature on the Earth's surface in an expanding universe. Half of the Earth's surface is being warmed by radiation from the Sun, at a distance of 200 solar radii. Radiation varies as the inverse square of the distance, and the temperature as the fourth root of the total radiative power. There is a correction of the fourth root of 2 because only one side of the Earth receives the radiation from the Sun. Leaving aside the maths, the Earth's temperature should be a bit below 300° K, [about 10°C actually]. Clouds, atmosphere and similar green house effects modify this a bit. But we are not in an average place in the universe, being so close to our Sun and **within** a galaxy of 10^{11} stars of the Milky Way [with a disk radius of about 25,000 light years across].

The average distance between stars is tens of millions times the star's average diameter, but most stars are within galaxies of about 30,000 light years radii, and the galaxies on average are only about 30 times as far from

their neighbours than their own size. So the average place in the universe will be outside of a galaxy, well away from any nearby stars and a lot colder than the Earth.

If the Earth was at a stellar distance away from the Sun, the temperature would reduce by the square root of a few hundred thousand [say 500] and the temperature would now be 0.6°K instead of 300°K [if only the Sun heated it]. With the whole Milky Way heating us, the temperature would be about 5°K. However, if the Earth moved a lot further out, to be at an **average** place in the universe, the temperature would be below 2°K.

Our universe is fairly transparent - on average, light travels a long way before it is absorbed - so that these distant stars show a stronger red shift as they recede from us at higher velocity. The very fact we see them at all shows that the universe expansion parameter, the Hubble Constant, is large compared with the transparency of the universe. In an opaque universe, where light does not travel far, modest sized regions can be virtually independent of each other as far as this radiation is concerned. The velocities of distant objects are then irrelevant because of the opacity in between that stops light ever being received from them. So an escape from Olbers' paradox requires that the coefficient of expansion, Hubble's constant, must be a large distance compared with the mean free path of the light in the region.

A dark sky therefore requires a high universe transparency, with the light of many objects with high recession velocities being visible - so that the faint objects should have very large red shifts. And this is what we do in fact observe. That is not all. By calculating how dark the universe should be, from its transparency, brightness of stars and the given Hubble constant, the universe should show a background radiation temperature of about 1oK if the distant, [and therefore much older] parts of the universe had similar radiation rates as the present [closer] universe. But Penzias and Wilson discovered the signature of the background radiation when trying to find the cause of radio hiss, and more recent measurements show that this background microwave radiation has a temperature of about 3°K. The reason for this discrepancy in temperature is that the universe **is** transparent, so most of the radiation does come from very far away, and the radiation therefore came from long ago in time as well. The background radiation shows us that the universe is not unchanging in time, and in the past it was much hotter . This is one of the main supporting pieces of evidence for the big bang and the subsequent expansion of the universe.

If there was a beginning, then light could not come from further out and further back in time, so the infinite number of shells contributing light from infinite times ago did not occur, and the sky is therefore a darker place, thank goodness! But if, as some astronomers have recently suggested, the big bang was only one in an even bigger infinite universe, then this light should have reached us, and blinded us with its intensity - so there cannot be more big bangs from a bigger and infinite time universe out there!

And all this from asking the question "Why is the sky dark at night?"

John Casey

What IC This Month

22 March – 17 April 2005

Overhead at 8.30 pm

Sweeping from west to east in the South - Achernar, then Canopus, multi clustered Puppis, Regor in Vela, the False Cross, Alpha Crux, and rising in the east the Pointers in Centaurus.

North- Starting west there is the V of Hyades with Aldebaran, mighty Orion, bright Sirius in Canis Major, Procyon, Castor, Pollux, the Sickle of Leo with Regulus, and Spica in Virgo

The Moon Diary

26/03 Full Moon
02/04 Last Quarter
09/04 New Moon
17/04 First Quarter

A **penumbral eclipse** of the moon will occur at 9 pm on the 24th April. Start watching an hour before as there will only be a slight darkening over the whole face at mid-eclipse. For those without a moon filter might be good time to observe some bright features.

The Sun will cross the equator into the northern hemisphere on 20th March at the autumn equinox which will make the path of the planets lower in the north

Evening Sky Planets

Saturn rises in the afternoon light still in Gemini just above "the twins". Since last year the planet has been "going backwards", in retrograde motion; but this month it will reverse and gradually creep away from Castor and Pollux to the east. During the next 30 days it will set between half past midnight and 11 pm; then on 16 April a 7 day moon will be below "the star with ears" in the western sky.

Jupiter rises in the late afternoon hanging around the bright white light of Spica in Virgo. Coming to opposition on the 4th April it is very bright in the eastern sky as darkness falls and will be visible all night. Although not the best approach to Earth the planet will reach 44" in size and will give good views of bands and zones especially with a light blue filter. Light green is good too. The moon will glide past and 18' above Jupiter on the morning of 27th March at 2.30 am. It's a Sunday so why not make the effort?

Morning Sky

Next to rise but after midnight mid March is **Mars** moving into Capricornus. It will rise around 1-2 am right through to September, setting during the daylight. About 3 am on 4th April a crescent Moon will lie above Mars in the morning.
Mars is close to Neptune in March and then on 13th April it pays a visit to Uranus.

Neptune rises in Capricornus round 1 am, while **Uranus** rising at 4 – 3 am waits in Aquarius for Mars in April.

Mercury is in conjunction with the Sun on 30th March but will reappear mid April but still close to the glare of Sol.

Venus is in superior conjunction, (behind the Sun), on 31st March but will return as the evening star in late April.

Comets

Linear K4 may be searched out moving north in Eridanus at 9-10 mag, look in the area round epsilon Eridani

Linear T4 should be brighter at 7th mag as it tracks through Delphinus, Equuleus, Aquarius and Capricornus in March and then through Sculptor in April. It should be visible 3° from M2 on 23rd March.

Comet 9P Tempel is brightening from 12 to 11th mag this month and is hanging round the border of Coma Berenices with Virgo. By the end of April it will be less than 1° from Vindemiatrix (epsilon Virginis).

Portraits in The Sky

Looking to the north, west of Arcturus and below Coma Berenices we find:

CANES VENATICI –
the other Hunting Dogs.

The two dogs are Asterion and Chara, both held on a leash by Bootes as they chase the Great Bear around the North Pole. It's one of those obscure constellations introduced by Johannes Hevelius in 1690.

With the exception of **Alpha CVn**, the stars are quite faint fourth and fifth magnitude. Several notable binaries can be found, and a number of interesting deep sky objects as well.

Alpha Canum Venaticorum is popularly called Cor Caroli (*Heart of Charles*). Most sources give Edmund Halley the credit, naming it after King Charles II after the restoration of the monarchy in Britain in 1660. (Others say it was referring to Charles I, after his execution.) The star has a visual magnitude of 2.9 (variable), a distance of 110 light years, and roughly the same size as our Sun. It is also a good double with a subtle colour contrast of soft blue and yellow, or two shades of white.

Double stars

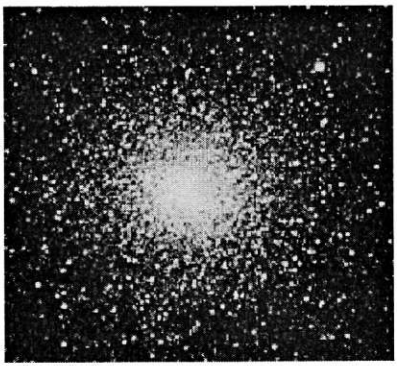
Canes Venatici has two attractive binaries. *Alpha*^{2} and *alpha*^{1} *CVn* form a celebrated fixed double star system.

25 CVn (Struve 1768) is a visual binary with an elegant orbit of 240 years. Presently, the companion is at near maximum separation, with a separation 1.8".

Deep Sky Objects

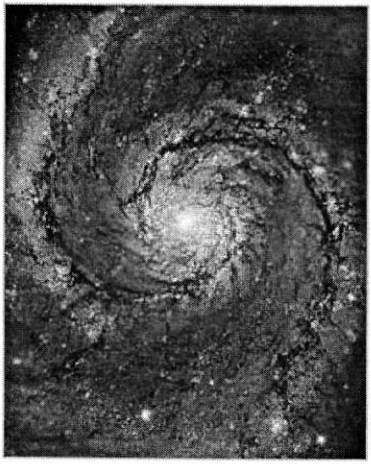
There are five Messier objects in this constellation, and many more deep sky objects worthy of attention.

M3 (NGC 5272) is a wonderful globular cluster found roughly halfway between Cor Caroli and Arcturus (in Bootes). Considered one of the finest globular clusters in the entire heavens, you'll need a large scope to resolve its individual stars. The cluster is about 45,000 light years away.



M3

M51 (NGC 5194) or *The Whirlpool Galaxy* is the finest galaxy in Canes Venatici. This spiral is very low to our horizon but can be found just above and to the west from the tip of the Big Dipper's handle. Some say the galaxy is 14 million light years away, others that it is twice that. In any case, you'll need a large telescope and a fine evening to enjoy its delicate detail, which includes an appendage system (NGC 5195), another galaxy seemingly hanging onto one of its extended arms.



M51

M63 is sometimes called the Sunflower Galaxy, for its numerous arms, which have been described as "like showers of sparks thrown out by a fiery pinwheel". Bright, at 8.1 magnitude, it has a very condensed centre. The galaxy is found 5° north-northeast of Cor Caroli.

M94 is a spiral seen face-on, and "comet-like". A compact circular spiral and very bright at 8.1 mag. To find it draw a line between Cor Caroli and beta CVn, and at the halfway point draw a perpendicular off to the northeast. About 2° up this perpendicular is found M94.

M106 (NGC 4258) is another bright spiral. The galaxy is 6° north northwest of Beta CVn.

Non-Messiers are **NGC 4244**: a large edge-on spiral, found 8° west of Cor Caroli. Located less than 1° northwest of beta CVn are **NGC 4485** and **NGC 4490** two splendid galaxies in the same field: Sometimes called the Cocoon Galaxy 4485 is more compact while 4490 is larger and brighter.

6° south of Cor Caroli and 2° west is **NGC 4631** a very large and bright galaxy seen edge-on. Just southwest of 4631, in the same field are two more galaxies, **NGC 4656** and **4657**

ARGO NAVIS:
was the fifty-oared ship that Jason and fifty Greek heroes used to recover the Golden Fleece. Built by Argus and piloted by Glaucus (represented by the star Canopus), with Castor and Pollux, (the Gemini twins) as part of the crew, they sailed to Colchis, at the eastern side of the Black Sea, where the Golden Fleece was guarded by a fierce dragon. After many adventures on the way, Jason stole the fleece and they all sailed back home.

Athene recognised their heroic deeds by placing their ship in the sky below and east of Canis Major. However it was Edmund Halley in his catalogue of southern stars, *Catalogus Stellarum Australium* (1679), that introduced Argo Navis to the world.

In 1763 Nicolas Louis de Lacaille's posthumous work *Caelum Australe Stelliferum* divided the gigantic Argo into

three constellations: Carina (the Keel), Puppis (the Stern, or Poop deck), and Vela (the Sail). To this day the Bayer (Greek) letters are shared with Vela and Puppis. This is particularly apparent in the False Cross area.

CARINA
"The Keel of Argo Navis"

Carina is home to **Canopus "The Helmsman"**, second brightest star in all the heavens. Named after the pilot of the fleet of ships King Menelaus took from Sparta to Troy in his fight for beautiful Helen. He won Helen for his queen, but Canopus died in Egypt after the fall of Troy.

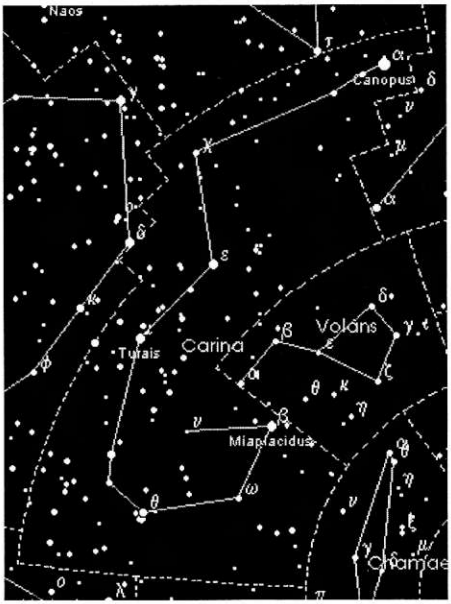
Canopus (alpha Carinae) was known in antiquity as the Star of Osiris and worshipped in many ancient cultures. This was the star that Posidonius used in Alexandria, circa 260 BC, to plot out 1° of the Earth's surface. Canopus still functions as a guide star in celestial navigation for NASA missions.

Canopus rising announces to the southern hemisphere the beginning of summer, passing overhead on December 27. Anyone living above latitude 30° north, that is Lisbon or San Francisco, cannot see the star at all.

Canopus is a golden-white supergiant about thirty-five times the diameter of the Sun with a luminosity of 12,000. Estimations for the distance of Canopus from us varied wildly for years but the Hipparcos satellite has calculated the distance at 313 light years.

The most interesting object is at the opposite end of the constellation **Eta Carinae** a mystery star varying in magnitude from a brilliant - 0.8 in 1843 to a rather dim 7 in the mid 1870s. Its present visual magnitude isn't much brighter, at only 6.21. The star's absolute magnitude has been difficult to assess, ranging from -5.3 to – 3.3.

The star is considered to be either very young, not yet on the main sequence, or very old. Currently the belief is that Eta is old and will eventually die in one of the brightest supernovae ever seen.



Eta Carina is found in the nebula **NGC 3372**, The Keyhole Nebula. The diffuse nebula has great complexity and beauty. While the nebula is composed of brightly glowing gas, there are darker areas which serve to break the nebula into individual islands.

The most dramatic of these darker areas has been labelled the Keyhole because of its shape. A telescope will show that the orange-red colour of Eta is a small nebula of

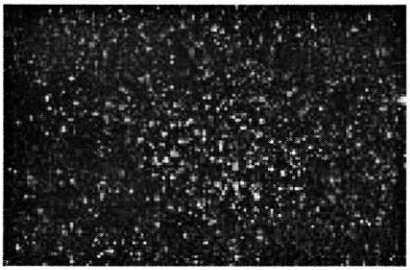
red light called The Homunculus surrounding the star.

Eta Carinae nebula NGC3372

Double stars in Carina:
Less than 1° to the north and 5 mins to the east from Eta is **Dunlop 94** a 5.0/8.0 red and white double star, 14.5 " easily separated.

Upsilon Carinae is another pleasant easily resolved binary of two white stars 3.0, 6.0, and a separation of 5.0".
Located at the point of a 3° triangle made to the south of *epsilon Carinae* and *NGC 2516* is **Rmk 8** two stars 5.0, 8.0, 4" apart. Difficult but not too hard.

Deep Sky Objects:



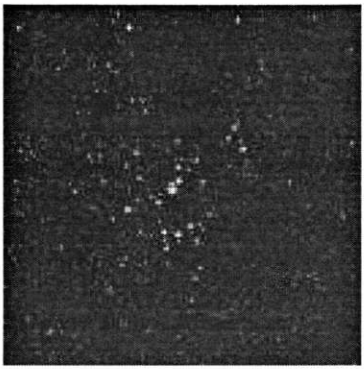
NGC3532

NGC 2516. A very nice open cluster below the False Cross of perhaps a hundred stars. 2516 has a colourful long history with MAS observers. *[If any newer members don't know the unofficial name of this cluster, ask our President Noel over a cuppa. Ed.]*
With a red giant at the centre, it's estimated at 1200 light years away. It has been titled the 'Southern Beehive'.

NGC 3532. located 3° WNW of eta Carinae is a spectacular cluster of four hundred or so mostly bright, sparkling white, A class stars. John Herschel thought this was the finest cluster he'd ever seen. Low magnification is desirable.

NGC 3293 just 2° north of 3372 is a tightly packed cluster that magnifies well. An orange star makes the cluster quite attractive.

IC 2581 about 1° north of 3293 has about 25 stars with a bright foreground star seeming to dim the cluster behind.



IC2602

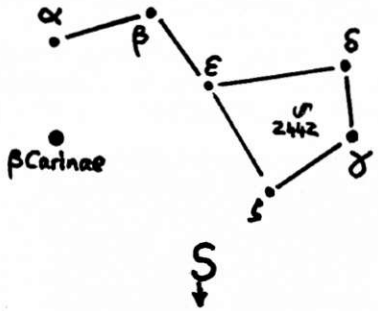
IC 2602 is a group of thirty or so stars some 700 light years away with ***theta Carinae*** as the brightest member. Some call it the 'Southern Pleiades'.

Roughly midway between ***iota Carinae*** and 3372 is **NGC 3114**. Easily seen with naked eye and a good subject for binoculars looking like a flattened S.

VOLANS
"The Flying Fish"

Volans was introduced by Johann Bayer in his 1603 star atlas. He called it *Piscis Volans*; but only the adjective has survived. The asterism looks like a plan view of a sting ray to me but if you imagine a sideways view of a fish leaping you might get the picture.

Tucked underneath Carina to the south, ***Beta Volantis*** is the brightest star and three other stars are brighter than *Alpha Vol.*



There are two fine binaries and a faint galaxy to be found, and the fan shape of Volans is a good guide to the Tarantula Nebula in the LMC.

Double stars:
Gamma² **and** ***gamma¹ Volantis*** form a fine binary, a deep yellow primary with a white companion 3.9, 5.8; have an easy separation of 13". Gamma² being brighter is the primary here.

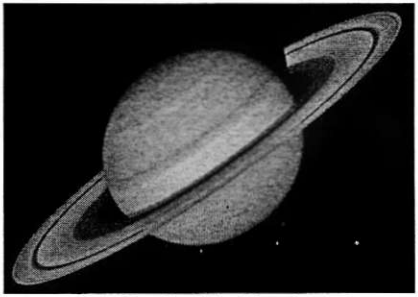
Epsilon Volantis is a double 4.5, 8.1; and a separation of 6.1".

Deep Sky Objects:
There is one galaxy here which may be of some interest, ***NGC 2442*** a faint 11.0 magnitude barred spiral galaxy, can be found midway between gamma and epsilon Volantis.

NGC2442

A slightly smaller galaxy with the same brightness (NGC 2434) is in the same field, just northwest

Good seeing IC ■



"Star" of the Month

A Brief Analysis of Matter (Part 4)

Frank Kish

This is the 4th installment of Frank's epic article.

3) INFINITY AND CAUSALITY

3.1 Infinity.

Philosophical Cosmology makes distinction between *non-material* and *material* infinity.

a) Non-material Infinity is the subject of Metaphysics. It may be worth noting here that Metaphysics deals with *abstract* (philosophically transcendent/unlimited) *ideas*, which could be considered infinite, *without* any spiritual or religious connotations.
Our mind cannot form, therefore cannot comprehend, *infinite* ideas, because the *basis* of all our *ideas* are originally formed through our mental process of *apprehension*, (quantifying a physical body), and *abstraction*, (qualifying its properties), from the physical reality. Therefore, we have to invoke some *logical reasoning* and *analogically* only from the physical reality may we reach some understanding of what *non-material infinity* might entail.
(This paper excludes any connotation with *spiritual* and religious ideas.)
Such *logical reasoning* may helps us to describe a humanly imperfect idea of a *non material infinity* through its presumed *attributes*, which are listed below:

It is an *undivided* unity, having no constituent parts.
It is a *subsistent* entity, with completeness in it.
It is *absolute* in every real sense of the word; it is without any conditions, non-subjective and non-relative to anything. It is a being by itself, above everything, and has the reason for existence in itself.
It has the highest degree of *perfection* and completeness.
Its *immensity* is unknowable by the rational mind.
It *transcends* the concept of any real space.
It is *immutable*, without any change, and without a beginning and an end in real time.
Quote: "It is like a giant wheel, whose center is everywhere and whose circumference is nowhere".)
(Note: The following *attribute* is a metaphysical "*stumbling block*" because it *adds* a strictly *spiritual* connotation to the concept of *infinity*. It is included here only for completeness sake for those interested:
Infinity is an *immanent*, in-dwelling, and *supreme agent* of the existence, operation and maintenance in all their states, of the finite *energy/matter/particles* throughout the physical reality, without contradiction of it being *absolute*.)

b) Material Infinity or *real infinity*, such as those claimed to exist in the physical reality, is hard to prove by science for or against conclusively. On the other hand, the physical reality is deeply rooted in the *abstract* structure of material principles throughout science and mathematics. Examples are the *constant values* of ***Pi***, the *Golden Ratio*, the *Random Fractals*, the ***L-System*** (growth), the *Euler Number* of **e**, and the *Irrational Number* of ***i.***
These are *real* numbers and *transcendental* because they transcend algebraic operations. The mathematician, F. Lindemann, remarked that the great constants of **e** and ***Pi*** are not merely irrational but far worse: "If these constants characterized irrationals as being hidden under a *cloud of infinity*, the

transcendental seem to be hidden under a cloud of algebraic inaccessibility". This pure abstract nature of mathematics, which by no means can be labeled as *material infinity*, gives it the *universal value*, i.e. its reliability transcends physical space and time.
Pure mathematics is driven by logic; applied mathematics is driven by logic and the physical reality.

Physical Cosmology appears to have the following problems that interest us here:
(i) How can a physical object have a *material infinity*, and *divisible* at the same time, (i.e. having individual units), have finite numbers, extensions and change; are there many, perhaps infinite numbers of such *infinities* in the Universe, and are some of them more infinite than others?
(ii) Does the concept of infinite *space* and *time* exist only in the mind or they do exist as *objective entities* in the physical reality as well? And if so, do they exist even in the *absence* of *material quantity* and in the *absence* of *change*, which supposed to be the *reason* for their very existence in the first place?

Philosophical Cosmology interprets that *energy/matter/particles* and *space/time* may tend or permitted to increase (or decrease) towards *infinity*, but by no means are infinity in themselves. Furthermore, matter as well as space and time, are *not actually* infinite in the physical reality, but they are *only potentially* infinite, i.e. *infinitely divisible.*

Infinite divisibility, however, is *unattainable* in the physical reality. Otherwise an infinite transitive chain of causes and effects would result in a vicious infinite regress.
It is *vicious* because one should complete an *infinite* number of acts to achieve the desired ultimate effect. In other words, something you can approach without ever getting there or you could die of thirst before reaching the tap. Since the meaning of *infinity* is that it has *no end*, the attainment of any finite action in a finite life would be impossibility.

The concept of *material infinity* contradicts logic, commonsense and the physical reality, regarding *energy/matter/particulates* and *space/time* concerned, because in principle, the *attributes* of real infinity expected to be identical to those described above for the *non-material infinity.*
Philosophical Cosmology proposes that *matter* is evidently *finite* because it demonstrates its **contingent** nature through the following principle characteristics:

a) *Finite* material objects ***exist*** within their evidently ***limited boundaries,*** *(*a mark of their contingency); therefore they require *finite* means of *measure.* We can define their specific *sets* by *counting* the *type* and *number* of things in them. We can add or take away from these numbers; we can determine, and alter their weights, dimensions, wavelengths and every form of change in the physical reality.

b) *Finite* material objects ***change*** in evidently ***limited time*** that we can *measure* with finite instruments, which would be impossible in *infinite time* where there is never a second, nor a century, but it is *always forever.*
c) *Finite* material objects ***cannot change*** nor can act freely, because they are *subject to* the universal *Laws* and *Forces of Nature*, which demonstrate direction and logic;
These Laws act in an astonishingly precise order, unalterably, without failing, reversibility, redundancy waste and without contradiction

with one another. One may ask: Where did all these *Laws* and *Forces* come from?

d) The final *criteria* for defining *material infinity* are suggested by philosophers:
(i), The small-scale, microscopic, *reality* should be extendable *downward* to infinity.
(ii) The large-scale, macrocosmic, *reality* should be extendable *upward* to infinity.

3.2 Causality.
We can understand and influence our world only through the knowledge of causal connections. Einstein said: "Scientists live by their faith in *causality*, and the chain of cause and effect. Every effect has a cause that can be discovered by rational arguments. But it just *fails* at the *beginning*. And that is really a blow at the very fundamental premise that motivates all scientists."

The word *cause* may have different meaning to different people. There are also many *types* of cause. Regarding an event, primarily it answers to the question of *"why"*, of which Aristotle proposes four types according to the *explanation* to it. A *Causal* explanation is accepted by many philosophers as explaining and verifying facts and events by saying *"yes"*. Its intrinsic meaning distinguishes it from an everyday type of explanation by a *conditional* acceptance of a fact or event by adding that something is "*accepted always*". This truth in *acceptance* implies a law-like *connection* by *necessity* between two facts or events, which distinguishes *causality* from an *accidental* regularity.
The understanding of this definition leads us into the very nature of material things, and approaching those *absolute* regularities, which are the sole examples of Natural Laws.

In Philosophical Cosmology a *cause* is anything that contributes in any manner to the producing or the maintaining an *effect* in the physical reality.

There are two major classifications of *cause:*
a) *Final cause* is the *end*, (i.e. teleological), towards which a fact or event is *aiming*. To explain a fact or event by its final cause is to explain it in terms of the *end-result* it achieves. This is also referred to as the "law of least action" of achieving end-result in the most economical way.
b) *Efficient Cause* is, (mechanistic), that which *initiates* the process of change. To explain a change by its efficient cause is to explain it in terms of *prior conditions*.

Note: The *Final Cause* seems scientifically simpler, yet both "causes" describe the same state of affairs and yield the same predictions.

The Aristotelian laws of *cause* and *effect* are not accepted by many cosmologists for their inevitable implications with the so called *Prime Cause*, (See Section 2). Others, on the other hand, accept it as a *fundamental principle* and a rock-bottom basis for our cosmological understanding of the physical reality. Some of the *cause/effect* laws highlight the controversy with regard to the earlier mentioned problem of *infinite divisibility*.
The *Laws of Causality* highlight their intrinsical ***contradiction*** with the concept of *material infinity*, their existence, movements and changes in an *infinite Universe*.

The following ***Laws of Causality,*** as laws of logic, apply to the *finite energy/matter/particles*, in a *finite Universe:*

Every Cause must end in an *Effect*; otherwise there is no Cause to speak of.
Every *entity* and ***event*** in the physical reality is the product of a *Cause*.
Therefore every *entity* and *event* in the reality is an *Effect*, which could become later a Cause.
Cause cannot be an *endless chain* of events. *Every chain* of events must have its Causes.
Cause can never be *unpredictable*, as every cause in the physical reality is a *reason* for existence with certitude of understanding it.
Reason can never be a Cause, as reason can only *explain* the physical reality that may not be self-evident to the mind.

To be continued...

Does anyone want to borrow MacDob, MAS's 6" Dobsonion telescope? If so...

Contact Bob Bee at a meeting or call him on 46474335

Baby, You're Hot!

An article in the Sunday Herald on 6th March provided the following interesting (and intriguing) information:

Astronomers have discovered a mini-star that shines like the Sun but is only 16% larger than Jupiter. It is the smallest hot star known and has implications for the search or extra-solar planets. Some of the giant planets discovered around other stars may, in fact, be very small stars such as this one.

Located in the direction of Carina in a remote part of the Milky Way, it was spotted by the VLT 8.2metre telescope at the ESO in Chile, Subsequent spectroscopic analysis has revealed that while 96 times Jupiter's mass, its volume is only 16% larger. Such a star, by conventional wisdom, would only ever be a brown dwarf (i.e. a failed star). However, this star is actually alight, burning nuclear fuel. (What was it that Shakespeare almost said? "The fault is not in the stars but in their theories.")

The density of the star is said to be 50 times that of our Sun.

My initial thoughts are: It's heavy enough but too dense for a red dwarf; It's a bit less dense than a white dwarf, and a bit larger (OK, a lot larger, being Jupiter size). And a white dwarf doesn't burn hydrogen. But it's hot like a white dwarf.

So what have we here? A new class of star? Don't you just love astronomy? Every time we think we've got it all nailed down, another loose floorboard pops up. RB

Brief Personal Observation

I had occasion to be observing Gemini the other night, and turned my scope onto Castor, α Geminorum. I knew it was a binary and each of those is itself a spectroscopic binary (hidden to us mortals). But to split the main star was fun. I had to use 180x to get a clear separation, but that might have been from the seeing or my collimation.
As an extra, though, there is a small red dwarf companion, a tiny red full stop at a decent separation from Castor's binary pair. Let me encourage you to check Castor out some time. It's easy to find and will be very rewarding. RB