MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal

PRIME FOCUS

Volume 9 Issue 6 **June 2004**

President's Report

All Aboard!

A big hello and welcome. Tonight it gives me great pleasure to introduce to you Dr John O'Byrne. John is the senior lecturer from the School Of Physics, Sydney University. The talk tonight will be on Adaptive Optics and how these optics have revolutionised how astronomers view the universe through telescopes. Should be great!

On behalf of our society I pass on my appreciations and thank John for taking the time to visit us. Thanks John.

Last time we met, Bob Bee gave a talk on White Dwarfs. However, I got a bit confused when Bob was speaking about the Pup. I thought he must have bought a new dog. All was explained as this little fellow was actually the companion to the Dog Star.

The Pup is a white dwarf star that is immensely dense, it shines at mag 8.4 which would be easily seen through a scope, but the dog star Sirius shines so brightly that you have a better chance of winning the lotto than seeing the Pup. Sometimes I feel a little dense, but Bob put me straight.

Bob says that the Dog Star's companion is the Pup and both reside in the constellation of Canis major, the Great Dog, not to be confused with the nearby constellation of the Little Dog.

Clear as mud. Woof Woof!

Fees:

By now I hope everyone has now paid their membership fees. If you haven't than you are very naughty. It's great to see that we have had a good influx of newer members to our club. Please take the time over a cup of tea or coffee after the meeting for a chat.

How Good Was That?

Last month saw us return to something that a lot of us really enjoy, that is holding open star nights for the community. I had lots of butterflies as I did the front running on the organization for the nights. Suffice to say with a little bit of help from my friends it was a great success.

But I have to take exception to those members who think I can control the weather. If the Saturday was to be cloudy the plan was to have Sunday as the default night. Without fail on every occasion that I have stargazed where the Saturday was a dud the following night has been clear. Well not this time!

However, there were moments of brief seeing and at one time it cleared completely enough to get in some fine views of the comet and Omega Centauri. When conditions allowed the views were brilliant

I did a rough count of the numbers for the nights and would not be too far off the mark at between 180 to 200 eager stargazers. The feedback we have been getting has just been fantastic. Even at the transit of Venus I had people commenting on when will be the next Oaks public night. So yes folks, we have another one planned, see dates below.

Coat Hangers and Cardboard.

A small force of MAS members gathered at the Macarthur Anglican High School to take part in what has to be the highlight of my entire astronomical life, the transit of Venus.

Well that and seeing the Auroras blazing overhead, that was pretty neat too.

The transit was unbelievable. The best views out of all the instruments would have to have been through the binoculars, words could not describe it. We met up with an old friend in the guise of one Eric Brown. Eric had his telescope focussed on the Sun and views were taken through a video link to a lap top, television and then into the main hall where the transit was projected onto a giant screen, just fantastic. With up to a hundred people it was a real blast!

I on the other hand had science teachers and learned students scratching their heads at the sight of my equipment, a small refractor with a solar screen made of cardboard and a coat hanger, real low tech that one! But it worked a treat.

Big Thanks to:

Dr Frank Stootman from the University of Western Sydney, Andrew Eaton from Macarthur Anglican High School, Dr Miroslav Silipovic who gave a talk and Eric Brown who composed the idea in the first place. Of course thanks to all our MAS crew. We also held a small star night later on and had a sausage sizzle provided for us, very nice indeed!

The Dates

10/07/04	The Oaks
17/07/04	The Forest
19/07/04	Monthly Meeting
24/07/04	Sports Ground Public Night, Oaks
07/08/04	Special Students Night, Forest
14/08/04	The Regular Forest Night
16/08/04	Monthly Meeting

The above dates can be taken as confirmed. However, poor weather conditions can throw

a spanner in the works and result in a cancellation, so contact John Rombi or myself on the day to confirm if it looks doubtful. My mobile is 0410 445 041.

Signing Off

Well that's all from me. I hope everyone enjoys the various activities of the club and thanks for all your great support. Let's hope for clear dark skies and lots of rain, but not on a Saturday night. Sorry, I forgot, I cannot organise the weather!

Kind Regards
Noel Sharpe President

The Great Wall

The Great Wall is the largest known superstructure in the universe. It is a 200 million light years distance structure which measures over 500 million light years wide and only 15 million light-years thick. It is not known how much further the wall extends due to the plane of the Milky Way galaxy, in which we are embedded. The gas and dust from the Milky Way obscure our view and have so far made it impossible to determine if the wall ends or continues on further than that which we can currently observe. As for the origin of the Great Wall it should be noted that current theory hypothesizes that such structures form along and follow web-like strings of dark matter. It is this dark matter which dictates the structure of the universe on the grandest of scales. Dark matter gravitationally attracts normal matter and it is this normal matter that we see forming thin long walls of super-galactic clusters.

Thank you Lloyd Wright ■

Hidden Worlds, Blunders, Inflation and the Big Bang

by J Casey 3/05/04

In the 1920s Edwin Hubble used the new Mount Wilson Observatory in California to observe the sky, but not by eyeball observations, like his contemporaries. He was trained as a lawyer, and later decided to change his career to be an astronomer. He had little formal training in this field, and probably because of this performed unusual observations for that time. He had the telescope set up with a mechanism that exactly countered the Earth's rotation, and so could point his telescope in the same direction for extended periods, and thus use photographic plates, instead of the eye ball to make prolonged observations. He could take very long exposures, and these showed up galaxies that were not visible to the naked eye.

Some of the galaxies his plates pictured were of the same apparent size as the Moon, but no-one had seen them before - because they were so faint. Other astronomers were shocked to find this hidden world. The Milky Way and the Magellanic Clouds were, of course, visible to the naked eye, but drowned out the obvious by too much detail. By observing the newly found, more distant galaxies, they could be seen as a whole, - as "islands of stars" floating in the universe. This in turn showed up the vast scale of the universe beyond our own galaxy.

Later Hubble found that the universe seemed fairly uniformly distributed with matter, if one considered galaxies as particles. He then tried to measure the velocities of these galaxies in our direction by measuring the

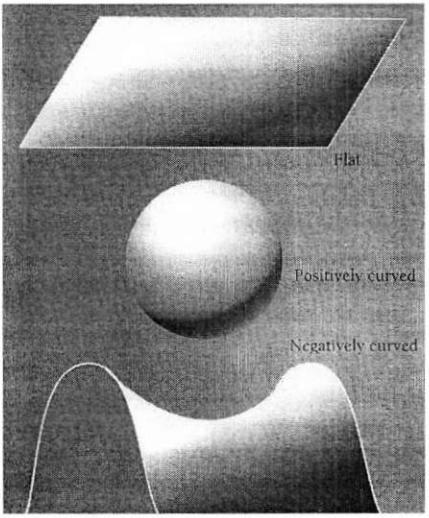
Doppler Shift of the light spectra - and found that they all seemed to be moving away from us, giving a red shift. He then found that the more distant galaxies were receding fastest - this became known as Hubble's Law, where that speed of recession is proportional to the distance away from us.

As we do not hold a special place in the centre of the universe, these facts showed that the universe itself was expanding. But it is not just that the individual galaxies are moving apart, it is the space itself that is expanding, carrying along the galaxies in their own little regions of space, as space itself blows up like popcorn. This then lead on to predicting the Big Bang - just run the videotape backwards through time, and the galaxies then all move closer together until everything collides.

The debris from an exploding hand grenade fly apart in much the same manner as the material from the Big Bang except that here space is not expanding. Working back from velocity measurements of the galaxies, the Big Bang was calculated to have happened about 12-15 billion years ago. Now Hubble's Law states that the galaxies' recession speed is proportional to their distance apart [not just from us, but from all other locations.] If such a speed had been from genuine movement, [describing standard movement in a fixed Newtonian space] then at some point that recession would exceed the speed of light. But it is not genuine movement, but expansion of space itself - and note that this does not have the same speed limit imposed on it - there is nothing that we know about to stop space itself eventually stretching faster than the speed of light.

Albert Einstein had modelled the universe with his relativity equations, and considered that some repulsive force was required to counter the attractive forces of gravity to give a uniform, static universe [which is what most astronomers believed in at that time]. He proposed using the energy of the vacuum of space itself to produce a uniform repulsive force to balance the effects of gravity [as spinning the universe around would oppose gravity in one plane only]. Einstein included a cosmological constant, Lambda (Λ), in his equations to represent this repulsive vacuum force. He found that he had to give the vacuum of space a very high negative energy to oppose the forces of gravity on the scale of the universe. But this would be evenly spread throughout the universe, so that on the scale of the solar system, the gravitational effects of matter would far exceed the reverse effects of the vacuum [so that the vacuum energy would be difficult or near impossible to observe].

But the Russian mathematician Alexander Friedman then showed that such a static universe would be unstable, and eventually it would either expand or contract. In 1922 he predicted the expanding universe from his own calculations based on Einstein's relativity equations. Einstein had hoped that his equations would have only one solution, to give his static universe. But Friedman had found an error in Einstein's equation, corrected it, and introduced three types of models of the universe. These were the closed, or spherical model, the open, or pseudo spherical, and the "flat" universes.



(NB: The 'negatively curved' model above corresponds to the pseudo-spherical model. Ed.)

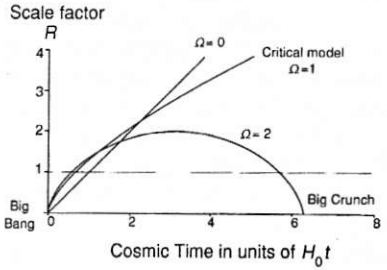
Using general relativity equations he showed that all models would predict an expanding universe, unless a fudge constant, such as Einstein's cosmological constant, Lambda, was introduced. But Lambda represented the energy of empty space, and cosmologists have since realised that it did not have to have a zero value. Einstein's blunder was to assign it a value that exactly balanced, by its repulsive force, the attractive forces of gravity.

About 10 years after Friedman's paper, Hubble made his discovery of the expanding universe, and in the light of this, Einstein declared that his cosmological constant was his biggest blunder. However, some recent observations suggest that the expansion of the universe may be accelerating, and if this is so, Einstein's cosmological constant may prove not to be a blunder at all. In fact, only the fudging of values of the cosmological constant to give a static universe - a perfectly flat universe, was discounted.

There are a few problem with the simple model of the Big Bang theory, [where all the fragments fly apart in real time]. One is the horizon problem - if nothing can go faster than the speed of light, then how come the universe seems so consistent in all directions back to the limits of our observations. When the baby universe was only one second old, the localised horizons would have been 300,000 km - the distance from the Earth to the Moon. And closer still to the Big Bang, the horizon over which matter can interact with other pockets of matter becomes smaller still. So how come the early universe was so uniform. There could not possibly have been interactions with other pockets of matter in regions **outside** of these local horizons to stir the pot and mix the matter together to make it consistent. It was like expecting milk added to a mug of coffee to become a uniform blend without allowing any mixing at all.

There was a second problem with the simple Big Bang theory. The "flat" universe implies a knife edge equality between the energy contained in the outward motion of matter and the gravitational energy opposing it. A number, called "Omega" (Ω) is used to describe the ratio of gravitational energy over the energy involved in the outward motion. For a closed universe, Omega is greater than one, and the universe will expand, slow, stop and then a collapse to a Big Crunch. For an open universe, the expansion will continue to slow, but the expansion will continue forever. The flat universe is on the knife edge between the others. The famous physicist Robert Dicke described this flatness problem of the simple Big Bang by showing that when the universe was only one second old, the

value of Omega had to be in the range 0.99999999999999999 to 1.00000000000000001, otherwise we would see no other galaxies, or the big Crunch would have already happened!



(NB: Different outcomes for universe for values of W = 0 (<1), 1 and 2 (>1). Ed.)

The probability that Omega is so nearly 1 is clearly not by chance! There had to be some factors present that drove the value of Omega towards 1. But what could they be? In the late 1970s a particle physicist, Alan Guth proposed a theory that might do the trick. It was called the Inflation Theory. It goes something like this: The very early universe was extremely small and extremely hot - too hot for particles to exist. As the universe expanded, it cooled, and at a particular temperature, around 10^{19}°C, this sea of energy would begin to crystallise into primordial sub-atomic particles. Like cooling of salt solutions in our cooler temperature range of today, crystallisation needs seed material to start it off, and so without such particles already present as seeds, the brew can supercool to below the temperature where these particles should form. Such a state is unstable and usually short lived. Alan Guth calculated the properties of this supercooled brew and discovered that it would be strongly gravitationally repulsive. It would result in a temporary, but huge cosmological constant that would cause a rapid expansion of the universe until the particles began to freeze out of the brew. When that happened, the rapid expansion would cease, as all this energy of expansion was instead diverted into producing the early forms of matter. One outcome of this rapid expansion was an inevitable flattening of the universe towards an Omega of 1.

The inflation idea has caught on, but the mechanism above was found to still have some flaws. However, for a number of years it was the only theory that seems to homogenise the early universe and overcome the horizon problem. Not that no-one tried others, but the Inflation Theory still has more support than the others. One of the more recent theories to overcome these problems - without the inflation period - really goes out on a limb. This theory was proposed by Joao Magueijo in the 1990s and requires, in this early Big Bang period, for the speed of light to vary. If this is done, then the problems mention above melt away - but at the expense of throwing away one of Einstein's primary assertions - that the speed of light is constant to all observers in all moving frames of reference [and, as well throws out the conservation of energy!!]

Einstein died deeply frustrated that he could not come up with a unified theory of electromagnetism and gravity [now called the Theory of Everything!] The problem gradually changed into a need to unify gravity with quantum mechanics. Cosmology and particle physics required the blending of the vast with the minute, and this turns out to be very difficult. Since Einstein developed his theory of General Relativity, gravity has been

considered a manifestation of the curvature of space-time, so quantising gravity requires the quantising of both space and time.

Such quanta are called the Planck length, and Planck time, and both units must be extremely small to go unnoticed. But if space and time were to be granular, their atoms should be absolute - but special and general relativity denies this. So neither Einstein, nor those who have followed have been able to overcome this problem.

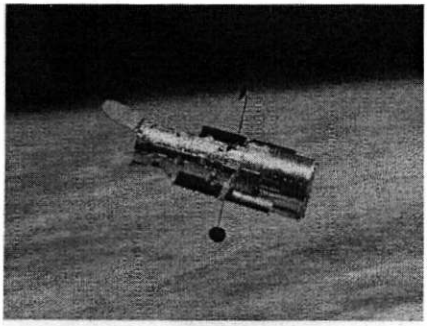
The two leading quantum gravity cults of the moment are called String Theory, and Loop Quantum Gravity. Neither is based on reality, on experiment or known particle physics. They seem to play celestial music, using rolled up extra dimensions smaller than the Planck length so they can never be observed - but each is a replacement of a sub-atomic particle. They vibrate with harmonics, like a guitar, each with its own celestial note, but predict that the lightest particles are trillions of trillions times as heavy as the electron! They need some adjustments to their theory! They also needed a world in 26 dimensions. But in the more austere times of late, more recent variants have lowered this to a modest 11 dimensions [or in one new variant, minus 2 dimensions!!!!] Maybe these physicists are as whacko as Jacko - or perhaps just out of our current dimension!

John Casey ■

Robots to Rescue Hubble ST?

NASA's chief, Sean O'Keefe, recently told American astronomers that the Hubble Space Telescope, which once appeared doomed, could be rescued by robots . He said the space agency was seeking proposals for robots to service the 14-year-old telescope, whose brilliant pictures from space have earned it a virtual cult following.

The American Astronomical Society has lobbied very hard to keep the Hubble telescope running. So have astronauts, politicians and thousands of citizens. NASA estimates that without repair work, Hubble will stop making observations by 2007 or 2008, when its batteries are expected to fail.



The goal would be to service the space observatory by the end of 2007. Space-walking astronauts were supposed to install new batteries and other gear on Hubble in 2006. But because of safety concerns after the loss of seven astronauts in the Columbia space shuttle accident last year, the 2006 shuttle mission was canceled in January. NASA indicated it was going to pull the plug on Hubble but this caused a huge outcry over

the loss of the telescope which had provided so many stunningly beautiful and scientifically informative images in its life time.

Thousands signed an Internet petition, NASA's email system was clogged with complaints and members of Congress demanded reviews. Even former astronaut John Glenn weighed in, saying another servicing mission was necessary "to get every year's value out of that thing." Other astronauts, many of whom had worked on Hubble over the years, wrote to O'Keefe arguing that the risk was worth taking.

O'Keefe has now agreed to consider the idea of using robots to perform the necessary maintenance, without putting astronauts at risk. Following reports of sucessful laboratory experiments, existing robotics projects have been accelerated to meet a strict deadline (mid-July 2004) to allow them to be evaluated and a decision made in time for the mission.

Astronomers see the continuation of the Hubble Space Telescope to be vital to continuation of great astronomical science. They argue that even with the plans for the James Webb Space Telescope to be launched in 2001, the HST should still be miantained. This is because if problems arose with the James Webb scope, either during launch or with the scope itself, they would be without a major space telescope if the HST was abandoned.

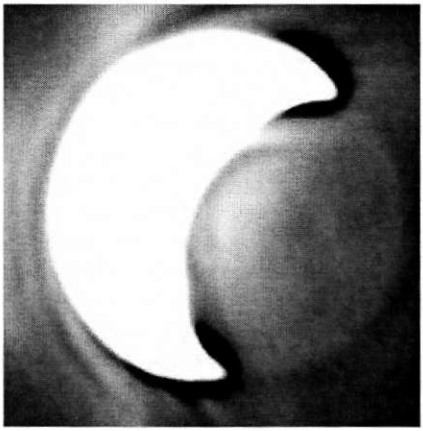
Let's hope the robotics projects can do the trick.

RB ■

Venus' Surface Captured by Amateur

The following article is from Sky & Telescope, written by David Shiga.

June 2, 2004: In a first for amateur astronomy, backyard observer Christophe Pellier in Bruz, France, has captured images of the eternally cloud-shrouded surface of Venus.



Using a 14-inch Schmidt-Cassegrain telescope, a webcam, and a 1-micron infrared filter, Pellier imaged Venus's night side glowing right through the planet's clouds on May 12th, when Venus showed a 19-percent-illuminated crescent. He has taken several more images since then, stacking 100 eight-second exposures to make each one. Pellier was not at all certain that his equipment would be up to the task, and he was surprised to see the glowing night side of Venus after just a few seconds. "It turned out to be much easier than expected," he says. "It's the proof that the best can come to anyone who is merely willing to try new things or difficult targets."

Pellier was responding to an early-May call by Sanjay Limaye (University of Wisconsin) to professional and amateur astronomers asking them to make coordinated observations of Venus in the near infrared.

The long exposures drastically overexpose the sunlit part of Venus, making it look much larger than its actual thin crescent. Despite this glare, about half of Venus's dark side is dimly visible. Venus' surface is hot enough to glow at 1 micron, and infrared light at this wavelength can emerge right through Venus' thick cloud cover.
The temperature of the surface varies with altitude, being less hot in more elevated regions, which show up as dark areas in the infrared images. A few dark splotches persist from night to night in Pellier's images, suggesting that they are high-elevation areas. "There is a large dark spot — I suspect that's topography, I don't think that's atmosphere," says Limaye. He and Pellier are still trying to match the image features to maps of Venus' topography.

Pellier's feat is a first not only for amateur astronomy, but for astronomy in general. Professionals have imaged Venus's surface from the ground in infrared light, but not for extended periods of time. "What Christophe has done is provided the first long-term coverage of the night side," says Limaye. "Believe it or not, we don't have that."

Limaye next hopes to see infrared images of Venus's night side taken with a coronagraph to block the glare from the bright crescent. He thinks amateurs will be able to do this faster and cheaper than professionals will, due to the complexity of professional observatories and their nitrogen-cooled infrared cameras.

The Oaks Open Night.

Well, after a drought of one year the residents of the greater Macarthur area finally had their astronomical thirst quenched, by the cornucopia of astronomers from The M.A.S. After ***"a lot"*** of behind the scenes work by our president Noel Sharpe, our society was able to hold its open night for the general public on May 22nd and 23rd at our new observing field, Dudley Chesham Sports Ground at The Oaks. We asked Bob Bee to promote the nights through his very popular column "Heavens Above", and David Everett also promoted the event through his program on C91.3.

The majority of high schools and primary schools were also inundated with personal invitations to come and see the Universe, and two of its most spectacular inhabitants, Comet NEAT C/2001 Q4 and Comet LINEAR C/2002 T7.

We engaged the services of The Oaks volunteer bush fire brigade as traffic and crowd control. This allowed us (the astronomers) to devote our full attention to the night ahead.

Ten members made themselves available on the Saturday night with varying instruments, 3 Schmidt- Cassegrain, 2 long focal length refractors, 1 short focal length refractor, binoculars and a swag of Newtonians on various mounts. Unfortunately the one thing we have no control over (the weather,) let us down. The majority of the evening was shrouded in clumps of clouds that allowed only limited viewing of Jupiter and some of the bright stars like Sirius, Canopus, and Alpha Centauri. But even though the sky was disappointing we still had approx 200 eager

people pay a visit to our telescopes, the weather did not dampen their enthusiasm with the questions coming thick and fast and with the occasional peek through the clouds. The satisfying sounds of "***oohs and ahhs"***told us that the universe had lost none its magic.

The Sunday night was again partly cloudy, and I'm sure that this is the reason that the crowds were down from the night before; Monday was also a workday for most people.

The one saving grace was that we had about forty minutes of totally clear sky, which allowed us to show The Main Attraction, which were the two comets. Our good friends the galaxies, nebula and globular clusters also took advantage of the clear weather and surrended their beauty to the people below. After our recent committee meeting (June 7th) we have decided to hold another night on Saturday July 24th. The Firies have indicated that they will be available again and that this time they will be selling hot food and drink for the eager crowd.

Finally I would like to thank all the people that helped put these two nights together and make them such a success.

John Rombi

What IC This Month
June 21 - July 19, 2004

Overhead at 8.30 pm

Starting in the western sky we have Spica the maiden star in northwest, Arcturus the guardian, the distinctive shape of Ophiuchus, Vega the Harp star and Altair the Eagle. Turning to the south-west you see the multi bright star area of Centaurus, Crux, the vivid shape of Scorpius and Sagittarius, rising out of the east is Capricornus and the crooked cross of Grus.

The **Earth** is at Winter Solstice tonight (21st June). Days will get longer again.

The Moon Diary

26t June	First Quarter
2nd July	Full Moon
9th July	Last Quarter
17th July	New Moon

Evening Sky Planets

Mercury rises in daylight and will set in Taurus between 5 and 7 pm. On 19th June, it will be in front of the Sun but will rise each night to pass Saturn on the 26th June just 30 min after sunset. On 09 – 12 July it will catch Mars 1 ½ hours after sunset, and speed past the Beehive cluster (M44) over the following couple of days.

Between 18 – 20 July low down on the western horizon, a one day old Moon will form a line of objects with Mars, Mercury, and Jupiter higher up. This is the best time to view Mercury in the evening but only till late August.

Mars sets earlier each night in Gemini between 7 and 6.40 pm. Mars will be into

M44 when Mercury comes up to pass it and climb higher. Both will be passed by a two to three day old Moon about the time of our next meeting.

Saturn remains in Gemini setting just 30 mins after the Sun at 6 pm. It is in conjunction with the Sun on 8th July and then becomes a morning object rising just before the Sun as July proceeds.

Jupiter is still sailing along in the underbelly of the Lion, setting between 10.30 and 9 pm this month. It is losing brightness as it moves to superior conjunction with the Sun. On 24th June a first quarter Moon will be close to it.

Last good views are right now as atmospheric interference dims the 'chief of planets'. We will have to wait till late October to catch its appearance before sunrise.

Neptune rises in Capricornus about 8.30pm and will be visible most of the night. It hasn't moved locality much over the last five years, but it is still a 'good catch' for your observing list.

Uranus has moved from western Capricornus to the middle of Aquarius since I have been observing it. This month it rises between 10 and 8 pm as it starts a westerly motion again which will take it back to Capricornus. Both Uranus and Neptune will be at their brightest in August this year so start tracking them now!

Morning Sky:

Venus after its transition, sets before the Sun in daylight for the rest of the year. It is now a morning object and will rise higher each day during July in Taurus, around 4 am.

Comets

Both NEAT and LINEAR have passed their best now. During May I tried to plot NEAT each night under light polluted skies. It appeared to be moving 6° or 8° each day. One night I found it on the border of Monoceros larger than usual. On checking a chart I discovered it was sitting bang on top of a Messier open cluster. No wonder Messier got confused in his search for comets, both types of objects look very much alike. If you still want to look, LINEAR is in Sextans but only faint and low in the west.

Meteors

The 10-12 July will bring meteors from the south-eastern sky around Phoenix. Best time is after midnight, They have been a bit unpredictable recently, however up to 10 an hour have been recorded in the past.

Portraits in The Sky

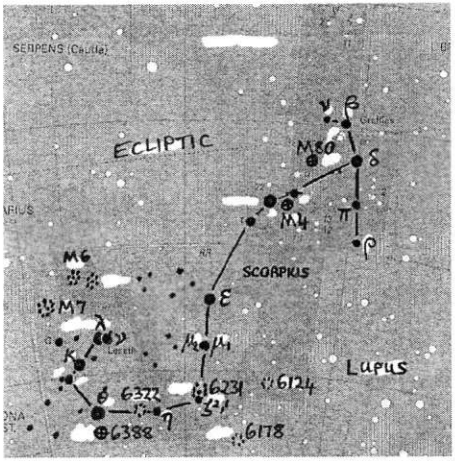
Beautiful **Scorpius**

If Australia were naming this constellation today we would probably call it the Crayfish or Lobster. However the ancients got there first so just keep that thought in your mind.

Forget about Antares and M4 for a moment and come on a journey to the centre of the galaxy at the other end down at the Lobster Tail (Stinger). Under a clear dark sky this is an extremely interesting area. Scorpius contains more than forty identified open clusters and more than twenty globulars.

The view in binoculars of this area is perhaps better even than with a telescope. Clumps of stars interlaced with dark lanes all jam-

packed together, sweeping down to the two stars that form the tip of the stinger. This is the home of the Scorpius OB1 Association. All you star wars fans please sit down; it's not the club where the other Obi Wan goes.



Lets begin at the sharp bend in the body of the Scorpion at ζ1 and 2 which is a naked eye orange-red and golden double with a third white star making a neat triangle in a finder scope.

Just ½° to the northeast is **NGC 6231** a cluster of eight bright stars in a crowded arrowhead shape. Put your scope on this even with moderate magnification and many more stars appear in the background. This is a famous object "discovered" by many astronomers over the centuries including Ptolemy, Ulugh Beg (15th C), Keyser our Dutch friend and Hodeirna (16th C), along with Halley, Lacaille, Dunlop and John Herschel. To be fair as telescopes improved each one saw a little more detail and drew more accurate conclusions.

Chains of stars, which are the outline of one of the spiral arms of the Milky Way, lead away to the north, a further degree, to be swallowed up in a glowing mass with dark lanes a little like the centre of the galaxy in Sagittarius. We now know this huge stellar cloud is connected with 6231 and is called a HII area of ionized hydrogen gas. The northern end of this cloud is also called Trumpler 24, (another 'discoverer') and is filled with bright stars arranged in pairs, triplets and groups of all descriptions ranging down to the limit of visibility.

Sweep north a further degree to come to **NGC 6242** a bright compact arrowhead of stars with a shining orange-red star to the south-east. Discovered by Lacaille in 1752, it sits in a nice field of dimmer stars.

Have a glance also at μ1 and μ2 which are less than 1° to the northeast. This is a naked eye double of equal white stars one of which is an eclipsing binary varying in magnitude every 34 hours.

Before we leave this end of our star field, using μ and ζ as a baseline, move your binoculars 7° westward till you come to what looks like another Omega Centauri. This is the galactic open cluster **NGC 6124** ½° in size and filled with twins, triplets and various groups of scattered stars, many of them orange in colour.

Also using μ and ζ line them up and extend a line out 2° and east 1° to find open cluster **NGC 6952** which has 100 12th mag stars crammed into 7', with a detached group of 15 stars to the west.
Coming back inside the curve of the scorpion tail using only low power, 2° NE of μ is a scattered open cluster called **NGC6281** with a

striking curved diamond pyramid of coloured stars and patterns at its centre.

Moving toward λ and υ which form the tip of the stinger, there is lots to choose from, depending on your eyesight and your scope. I couldn't find the Bug Nebula NGC 6302, searching with a quarter moon in the sky, but they tell me it is relatively bright. There are three Gum nebulae here for the astro-photographers, one of them **NGC 6334** is called the Cat's Paw. I did see something which I am calling the "Prancing Dog". If you want to find it, ask to see my star chart.

MIbO4 is a triple star discovered by observers at Melbourne Observatory late 1800s. The bright 5.9 magnitude orange star has a 10th magnitude companion 31" away. However the bright star has a similarly bright K class star just 2" away that orbits every 42 years.

OK, now we are looking east of the stinger and naturally the most obvious naked eye object here is **Ptolemy's Cluster (M7)**. Using binoculars or very low magnification with light pollution it looks a bit like a spider. With the stars arranged in clumps starless lanes are created across the cluster. At 900 light years from us it is among the nearest clusters.

The other easily seen object close by is the **Butterfly Cluster** or **M6**. Twice as far away as M7 a telescope is needed to bring out its best view. Most novices can easily see the wing shape brightly outlined in a 1° eyepiece.

Out of more than twenty Globular Clusters, we will look at 3-4 this month which are usually overlooked. The first of our GCs is an easy find beside the bright tail star 'G' which is about 2° north of M7. Using a scope and low power magnification you can find **NGC 6441** hiding away in the glare of the brighter star in a starry field. Higher powers will allow you to isolate the GC without the glare of the star for better resolution.

The second is likewise situated beside a bright star. Follow the line of stinger stars out to the southeast for an equal length and beside two to three medium stars you can find **NGC 6541**. Strictly speaking this is not in Scorpius at all but across the border into Corona Aust. However it is a nice GC also 3.5' dia like the previous one, well defined in a pretty setting.

Our third GC **NGC 6388** is on an extended line from ι and θ Scorpii about 3° away and 1° down to the east. Again it is small, tucked in between stars but glowing brightly in a starry field.

The last one is a real challenge and we return to M7. In fact **NGC 6453** is tucked in among the outskirts of the cluster on the northwest side. There is a bright orange star just 21' away . In any scope under 300mm it will be a success if you discern the faint haze of this 9.9 magnitude 3.5' round glob. No hope under any but the darkest sky. But then that's what challenges are all about, isn't it?

Nothing better than some hot Lobster tail on a chilly night!

Good seeing IC

Tales of the Transit

Ian Cook:

11.00 am I get a phone call from a GP doctor in Bowral who wants to know where he can buy a solar filter before 3.00pm I offer to sell him some Baader solar film if he comes to my home. 1.30 pm I give him some solar film and cardboard cutouts to fit over the telescope which is at his son's school, and he exits to Southern Highlands at high speed. Give me a phone call, I say, if it's a great success!

2.30 pm I set up my own gear on the nature strip in front of my house. Passing teenage male asks politely, what's that big tube. I explain that in 45 mins Venus will pass in front of the Sun, and if he likes to come back then he can see it. I've got nothing to do, he says, I'll wait here. I give him Astronomy 2004 to read while I carry on. I hear him ringing his mate to tell him to come down; he's going to watch "Jupiter go into the Sun!!" His mate turns up as well as our next-door neighbour, some children going home from school, people off the bus, and several cars screech to a halt when they see the telescope.

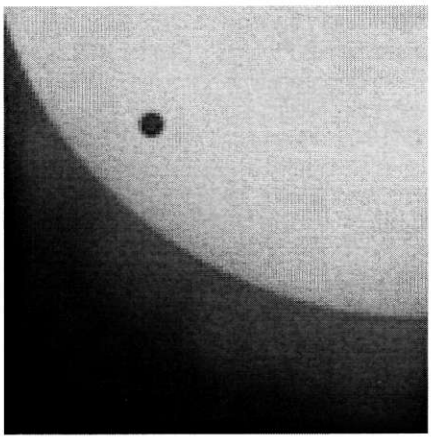
3.07 pm we see the first dimple shape creep into the Sun's disk in both the telescope and my binoculars which I have rigged up as well. Some people see better with the binoculars than the eyepiece. We take turns going from one to the other. "That is just so sick", says my first teenage friend. I explain about the 'tear drop effect' and he will be one of the few people in this suburb to see it, Wow!

We wait with anticipation. Each person is quickly looking and moving on to allow others to look now, and there it is! I think. We do see a hint of a tear drop for a few seconds, more like a mirage effect, right on the Sun's limb.

By this time two other teenagers have rolled up with school bags on their back, friends again of the first. So we talk about the atmosphere of Earth and Venus causing the tear drop effect and one says, "yeah, our science teacher was talking about that today."

All together over 30 minutes we had about 20 people of all ages, stop and get a view of this transit. Writing this that same evening I haven't heard from the doctor, but I hope they managed to get a good view. I was glad I had made preparation and was able to share the experience with others.

IC



Venus is well inside from the Sun's edge.

John Rombi:
Transit of Venus and other "mashugana"

An historical moment in astronomy occurred on Tuesday 8th June 2004, the first of two transits of Venus since December 1882. The next transit will occur on June 6th 2012. We at M.A.S. were very privileged to be asked by Dr Frank Stootman of U.W.S Macarthur if we could join him and make ourselves available to The MacArthur Anglican High School for this very important day.

Dr Miroslav Filipovic, a colleague of Dr Stootman, gave a lecture to the assembled students, staff and invited general public on the mechanics of this special occasion and what to expect when they greeted the astronomers.

Dick Everett, Lloyd Wright, John Koster, Noel Sharpe and I, set up our instruments outside the hall. Unlike the safety of night-time viewing, solar observing can be very dangerous unless certain precautions are taken. There are only three ways to view the sun safely through a telescope:

1. Project the image onto a white piece of paper, taking care not to look through the eyepiece at any time.
2. Direct viewing, you must place a filter made especially for solar viewing over the end of the scope, before the light enters the tube.
3. Project the image to a video camera; this can then be fed to a screen or monitor.

The assembled mass waited anxiously for the 3.07pm start.

Suddenly a shout came across the field, " I can see it." Before I could identify the voice, another cry echoed across the field, "I can see a big black dot." With this, the crowd converged on the telescopes eager to be one of the first to view this event.

When I first saw Venus crossing the sun, my first impression was that it was much bigger than I thought it would be. Over the next two hours we all had a constant stream of people coming back for their 5th or 6th time, going away amazed at what they were seeing.

At 5.00pm when the sun set the transit was only half way across the sun, we were all directed over to the canteen for a much needed sausage sizzle. We were enjoying our break when a voice came over the loudspeakers that the first sighting of Jupiter had occurred, a large stampede of people made their way back to the telescopes, only to find that they had left the astronomers behind still eating their dinner.

The enthusiasm shown earlier in the day continued into the evening as the crowd were shown Omega Centauri, The Sombrero Galaxy, Jupiter, Saturn, Eta Carinae, Alpha Centauri and the many other splendours above.

The evening finished by 7.30pm with a group of very tired astronomers and a very grateful general public, hoping that they could experience the wonders of our Universe again soon.

Nanoo Nanoo. John Rombi.

Bob Bee:

At the last moment on Monday night (7th June) I obtained some Mylar filter sheet from Dick Everett. Just enough for my 12x50 binoculars.

It had occurred to me that on Tuesday I would be out at my firm's Wallgrove site, and between meetings I might have an opportunity to slip out to the car park and have a peek at the transit. At least then I would be able to say "I saw the transit with my own eyes." It was going to be a quick private viewing. Little did I know!

After a lot of messing about with the mylar, masking tape and cardboard, I was able to fashion robust and light-proof filters for my binoculars. At mid-night on Monday, I stood within a foot of a 100 watt naked light-bulb and stared into it with my binoculars. All I could see was a very faint reddish glow shaped like a light bulb. No other stray light. This convinced me that my eyes would be safe to look at the Sun. (Thankfully, it turned out I was right.)

I was still in a meeting at 3.05 pm. I had my binoculars on the table next to my note pad. At 3.10, I said to the two people with me: "I'm calling a short break. I have a historic transit to see." Great, they said. Can we look too? So the three of us waltzed out to the steps outside the main Depot entry. I also had my $5 cardboard framed sun-filter spectacles with me so I handed them to one companion while I double checked my binoculars for leakage. (One can never be too safe when it comes to your eye sight.) All OK, so I turned it on the Sun. Wow! There was a small but distinct black circle nudging into the Sun's orange disc. My friend with the spectacles (no magnification, mind) reported that he too could just make out a black speck in the same spot. We agreed it was at (approx.) the one o'clock position.

Then I heard voces behind me. "What are you looking at?" I turned and found half a dozen engineers and office staff standing there, and more were drifting out of the office. Even the local Manager was there. I explained about the transit. Is it safe to look in binoculars? they asked. I explained how I had used special filter material to make it safe, and that I and a few others had already looked quite safely.

For the next 20 minutes or so, a string of over 20 people – engineers, technical officers, office ladies - patiently took turns to use the spectacles and then binoculars to view the transit. They were fascinated. Around 3.30pm, I got to have another good look and by then Venus was well into the Sun's disk. I was impressed with the quality of the view in simple binoculars but I was a bit envious of my MAS friends who would be viewing it at higher magnification in telescopes.

Unfortunately, I then had to return to the meeting to complete my work and by the time the meeting was over, the Sun had set, so I saw no more of the transit except for the great shots on the evening TV.

So my little 'private viewing' had turned into a mini public viewing. It was certainly a thrill to witness an event that brought Cook to the South Seas over 230 years ago. I was able to explain to my engineer colleagues on the office white board how they used it to nail the value of the Astronomical Unit.

Now I have to wait to June 2012 for the next one. RB