

MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal



PRIME FOCUS

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President's Report

A big welcome to all members and guests as we find ourselves at the last meeting for the year. Hasn't the year just flown by.

Last month our very own Bob Bee gave a fantastic and dare I say "illuminating" talk on the life cycle of stars. This talk had everything, all the way from the periodic table to the main sequence. Thanks Bob

Continuing on our star theme it gives me great pleasure to welcome to our society Dr Dick Hunstead. Dick is a professor at the University of Sydney. He has spoken to many astronomical societies and we are honoured to have him join us. His topic tonight will be on Quasars and he has kindly volunteered a synopsis for tonight's talk as follows.

"Quasars, big and small.

The discovery of quasars in 1963 opened our eyes to the distant universe, giving us

powerful beacons that could readily be seen out to red shifts of 2 and beyond. Not only did they serve to push back the frontiers to something like 90-95% of the age of the universe, they also turned out to be valuable probes of galactic evolution. I will describe my involvement in this saga, give an update on our current understanding, then draw some interesting parallels between the properties of real quasars and their much smaller and closer analogues known as microquasars."

I'm sure everyone will make him feel most welcome.

Has anyone else caught up with up with the latest Sky and Space magazine. This issue is packed with articles, as well as extensive product advertising with a ton of scopes if your considering a purchase or two. I like the style and read of this new issue, but it makes me think someone planted a spy in our society as many of the articles make reference back to many items discussed at our meetings.

There are stories on the latest really big telescopes, Martian space probes, FANS night, and a while back Bob Bee gave us an introduction to Quaoars. Telescope enthusiasts will be pleased with the review on Bintels 302, a whopper of a scope that's a financial possibility for those who don't have an unlimited spend.

A review of four starter telescopes is full of very good tips and even the more experienced of us will enjoy these reviews. Good to see those guys from Astro optical, Bintel, York and Andrews Communications receive representations.

The article on Mars is fantastic with a request for any drawings of Mars to be sent in. Apart from my son's imaginative doodlings we have a very dedicated member who has excelled with the pen and paper, so why not give it a go.

I don't normally make recommendations, however a vibrant, newsworthy and frequently published national magazine on astronomy is a must for us folks down under, so for seven bucks what have you got to loose?

Upcoming

It's that time of year where the Yule tide comes in and daylight saving is in all its glory, so here's a short list of activities.

22/11/03	Forest night
29/11/03	The Oaks
07/12/03	Christmas Party
19/01/04	General Meeting

Hopefully tonight we will have some Astronomy 2004 to off load. This very valuable book helps us in arranging dates to observe. Also be aware that we will be doing some observing at The Oaks over the Xmas and January period. Please contact us for details on 0410 445 041 as per usual arrangements.

On the Agenda

Since the Society's inception we have had the support of the University of Western Sydney Campbelltown campus. They have offered us this room as our home base for our monthly meetings and have given us access to audiovisual equipment and projectors, this has been provided without cost to the Society.

We have also enjoyed holding many public nights up at the Campbelltown Rotary Observatory. Unfortunately this part of our operations will cease next year. The reasons are complex and centre on the University's position that their public access observatory is at their Nepean facilities.

The facilities at Nepean are purpose built to provide for the general public, things like meeting rooms, toilets and upgraded security systems. Also the university pays for tour guides to show the public the night sky. The telescopes here at Campbelltown have been designated for teaching and student research. To further complicate things public liability issues have become a major stumbling block.

I am aware that the university's position has created some concerns within the membership and these have been raised with the committee. At the moment we are still gathering members' opinions in order to

adopt a position. The director of the Campbelltown Rotary Observatory, Dr Ragbir Bhathal has indicated that he would be willing to address the membership early next year in order to explain things more fully. Please feel free to discuss your feelings to myself or any of the committee.

In Closing

May I take this opportunity to wish everyone and their families the very best over Xmas and the New Year.

Regards
Noel Sharpe President

What IC This Month

Nov 17 2003 – Jan 19 2004

Quick Sky Tour

Zodiac constellations in November start with Sagittarius sinking in the western evening sky and stretch across to Gemini in the eastern morning by January.

Bright stars in the north will be Altair (Aquila), Deneb (Cygnus), Aldebaran (Taurus) and Orion

Bright stars in the south include Fomalhaut (Piscis Austrinus), Achernar (Eridanus), Canopus (Carina), Sirius (Canis Major), Gamma Velorum (Vela), the Pointers and the Cross.

The Moon Diary 2003

New 24/11, and 23/12.

First Qtr 01/12,

Full 08/12,

Last Qtr 16/12,

Moon Diary 2004

First Qtr 01/01

Full 07/01,

Last Qtr 15/01

The Wandering Planets

Mercury rises in Scorpius and joins Venus in Capricornus to play follow the leader through the clusters and nebulae of Sagittarius. Late November it will have close passes with Antares and the thin crescent moon but best views are in the western sky early December when it will set 2 hours after the Sun. Mid December it will plunge to the horizon arriving in conjunction with the Sun on Christmas Day.

Venus in late November will be among the Sagittarius Star Cloud. On 25/11 Venus and Mercury will engage in a short dance in the west around 8.30pm before coming within 1° of M8 on the 28th. Moving into Capricornus during December Venus will be near Neptune on the 30/12 and near Uranus in Aquarius on 15 Jan 04. Venus will move quickly onto Pisces, Aries to arrive in Taurus before we lose it in April.

Neptune and Uranus continue in Capricornus and Aquarius respectively, separating further from one another as the months go by. These two planets have kept company with each other ever since I joined MAS eight years ago. They were a lot closer before that but they now part company for a long long time. Does anybody know when they will join up again?

Mars is settling back into a more normal size and magnitude for the next two years when it will pass the Earth again. It continues travelling eastward towards Taurus and Gemini and a date with Saturn next year.

During Dec/Jan there will be some meetings with the Moon in various phases.

Saturn rises in Gemini about 11pm on the 197/11 and will continue in the constellation for the next two and a half months. The Moon will pass by on the 11/12 and 6th Jan 04, but Saturn just gleams on spectacularly in your telescope. The rings are moving towards edge-on, so keep observing.

Jupiter rises among the legs of Leo about 2.30am on the 17th Nov. It will stay in this vicinity well into 2004 when it will be viewable at a more reasonable hour

Comets and Meteors

2002/O7 passing through Octans Tucana and Grus will fade to 9th mag as it disappears in the morning twilight by months end.

2P/Encke will be lost in the evening twilight before it gets to naked eye brightness. Hope you got to see it near M31 last month!

As mentioned last month the **Alpha Monocerotids** will peak on the 22nd. Although erratic they can produce up to 400 per hour in the morning hours.

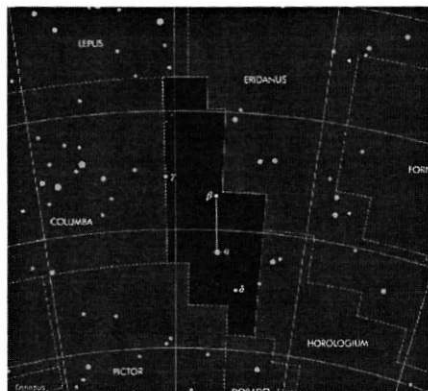
Sky Portraits

This month we are focusing on the south circumpolar region. Yes, the figures are faint and some have few spectacular objects, but if you claim to be an observer, here are some challenges for the Christmas-New Year season.

CAELUM - the Engraving Tool

Nicolas Louis de Lacaille introduced Caelum around 1752, to fill in a gap between Eridanus and Columba in a particularly bleak part of the southern hemisphere.

He had in mind a type of engraving or carving tool in Latin called *caelum* (pron. kyelum) meaning "the heavens" and also "burin", a French instrument used for engraving on copper and fine metals. Perhaps this was one time when Lacaille let his imagination fly and he called this 'the engraver of the sky'. In fact Lacaille drew two of these instruments in his original map, calling the constellation "Les Burins", but only one has survived.



There are few Bayer stars here, and none brighter than 4th magnitude. There are two published diagrams for *Caelum* and one observing challenge for this month is to note and observe the shape of the "sky engraver".

Double stars:

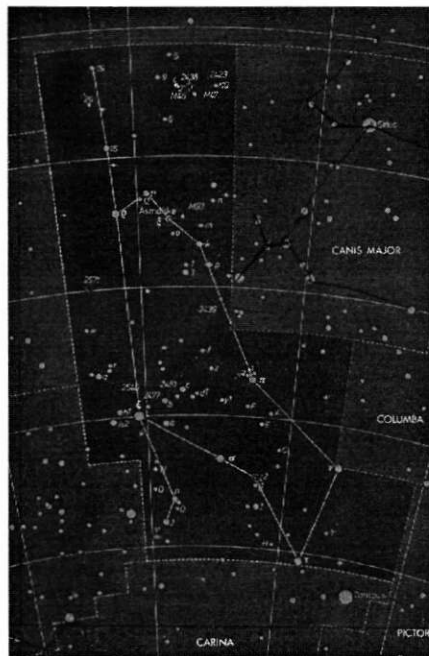
Alpha Caeli is a binary if you have a scope larger than 225 mm (9 in). It has an extremely faint companion: 4.5, 13; separation 6.6".

Gamma Caeli also has a faint but close companion: 4.6, 8.0; separation 2.9".

Deep Sky Objects:

Hartung indicates one 12th mag. spiral galaxy, **NGC 1679**, which is about 2° south of zeta Caeli. There are many other faint galaxies.

PUPPIS – the Ship's Stern



Puppis, "The Stern", or Poop Deck, sails into the zenith in January and is the largest sub division of the former constellation "Argo Navis" - the Argonauts' Ship. It was Lacaille who dismantled the older constellation in the mid-eighteenth century, breaking it into four smaller parts: Carina, Pyxis, Puppis, and Vela.

The constellation spans a rich area of the Milky Way, guaranteeing a number of fine objects to study. It does not have a complete set of Bayer stars due to being split off from the large older constellation.

Double stars:

9 Puppis is a very close binary with rapid orbit of only 23.18 years. Currently the values are: 5.6, 6.2; PA 315°, separation 0.4".

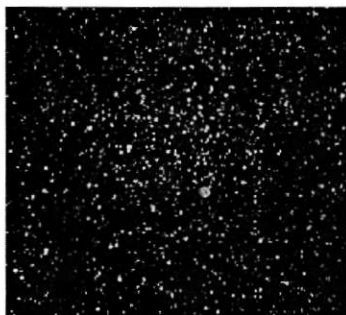
k¹ Puppis and **k² Puppis** form a noted system of nearly equal stars: 4.5, 4.7; separation 9.9". Note that the "k" here is not "kappa"; many of Puppis' stars are English labels.

Variable stars:

Rho Puppis is a delta Scuti type variable: 2.68 to 3.87 every 3h 22m 52s.

Deep Sky Objects:

M46 (NGC 2437) (see below) is a fine open cluster of perhaps five hundred stars about 4000-5000 light years away. Sitting on the northern edge of the cluster is a planetary nebula, **NGC 2438**, which is about 3000 light years away. The cluster is found in the northern portion of the constellation, 11° east of Sirius (alpha CMA) and 2° north.



M47 (NGC 2422) is a bright open cluster in the same field as M46, just 1° west of M46. Of the two, M47 is the brighter, as it includes several 5th and 6th magnitude stars.

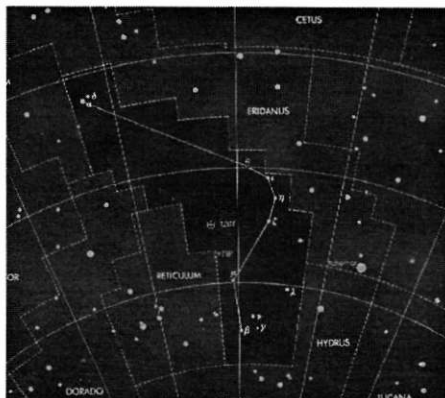


M47

M93 (NGC 2447) is another open cluster, quite bright but smaller than the two previous objects. It's found 1.5° NW of xi Puppis

NGC 2477 is a very fine globular cluster 3° NW of zeta Puppis, nearly half way between pi Puppis and zeta Puppis.

HOROLOGIUM – the Pendulum Clock



Originally named Horologium Oscillatorium by that master of imagination Lacaille in 1752 it really does take a stretch of invention to see a clock in this group of dim stars.

The constellation boundary is just north of π in Hydrus and then swings away to the left, in a 25° length boomerang shape. However it can be confused with the brighter stars of Eridanus which follow the same shape.

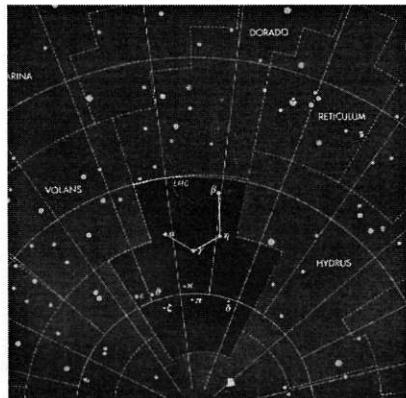
There is only one star brighter than mag.5 and that is the yellow giant α . But there are two globular clusters for 150mm scopes and up, **NGC1261** in a nice field at mag.8, and **AM 1** which is the most distant globular in the Milky Way but only 15th mag. There are no open clusters, no nebulae, and no double stars.

See if you can trace out the shape of 'The Clock'

MENSA – The Table Mountain

Our next target going to the right around the Pole is Mensa. You will find it under the cloud, yes The Large Magellanic Cloud! Nicholas Lacaille went to South Africa to observe the southern skies and named **Mons Mensa** in honour of Table Mountain at Cape Town, which often had clouds sitting on its summit. The LMC is poised like a cloud above the flat top of Mensa.

The constellation is dim and not obvious, however if you consider that parts of the **LMC** lie inside the border of Mensa there is good reason to familiarize yourself with some of the objects of interest this summer.



February 2001 issue of Astronomy (USA) had a simple map of some bright objects in the LMC area, but it can be quite confusing to distinguish one from another. Certainly look at **NGC2070 The Tarantula Nebula**, but also look out for a tight cluster of stars south of 2070 and really boost your magnification for 30 Doradus in the centre of the spider.



Keep the stars in your eyes over the next two months and we will see you in January.
Good seeing IC ■

Club Fees for 2004

Please note that payment of membership fees will be due by the end of February 2004, so please put that little bit aside for the new year. As for last year, the fees are:

Once-off Joining Fee: \$10

Annual fees:

Members : \$30

Family Members: \$50

Student Member: \$20

Pensioner member: \$20

Mail-out of Prime Focus: \$5

MAS Christmas Party

Why not end the astronomy year with a bang – or at least a sizzle – by joining us for a Christmas BBQ:

When: Sunday 7th December
Starting 4.30pm

Where: Pembroke Park, Leumeah
Pembroke Road

What : BYO everything.

Barbecues are provided on site.
Lots of swings etc and running room for the kids.

Light, Motion, Time, and Space by John Casey

Ideas on Motion

Motion, the changing of location over a period of time, was deeply discussed by philosophers in many different ways over the centuries. **Descartes** wrote a book in 1632, after a revival in interest about old Greek ideas [on matter being made of indivisible atoms], and the [then] recent telescopic observations of planets by Galileo.

Descartes was the first to clearly state the idea that **all bodies move through space in a straight line, at constant speed, for ever, unless acted upon by an external force**. He did not publish his book - because, in 1633, the Inquisition condemned **Galileo** for teaching that the Earth moved. The Earth would not then be, as the Church proclaimed, **the centre of the universe**. The ideas of **Copernicus**, supported by Galileo's observations were central to Descartes' book, so he avoided Galileo's fate by not publishing his book at that time. He did publish it later, in 1644, in his influential "**Principles of Philosophy**". But he entwined it in a theory of **relative motion** that said that motion can only be relative to another body, [so no one could say which was moving]. This stopped the Inquisition pursuing him, as he argued that the Earth was carried around the Sun in a huge vortex that carried space around with it, so the Earth did not move in its nearby space.

Charles Newton studied Descartes' work around 1670, about 20 years after Descartes' death, and immediately saw a flaw, in that **to say a body moves in a straight line**

presupposes a fixed frame of reference - which Descartes had denied. Newton saw the great potential of the law of inertia, but to exploit it, he needed to come up with the **concept of an immovable space - in which all motion was to take place**. When he published his own laws in 1687, he introduced the notion of an **absolute space and an absolute time**. He acknowledged that both were invisible, and that only relative motions could be observed.

Descartes, in his book, had claimed that **light from the Sun was pressure transmitted from the Sun**. He claimed that this was by centrifugal tension set up in the vortex that he pictured swirling around the Sun. **Newton refuted this argument with an example**. He imagined a bucket filled with water suspended from a rope from the ceiling. The bucket is rotated many times to twist the rope, then the bucket is held still until the water settles. When the bucket is released, the rope unwinds and the bucket spins.

Initially the surface of the water is flat, but as the motion of the bucket is transferred to the water, it too begins to spin and begins to rise up the side of the bucket. Eventually there is no relative motion of the bucket and the water in it, and the water surface reaches its greatest curvature. Newton asked "**what caused the water surface to curve?**" Descartes had claimed that true philosophical motion must be relative to the immediately adjacent matter. But for the bucket and water the relative motion was greatest at the start, when the bucket spun, and the water did not - and there was no curvature on the water surface. When the relative motion was stopped, as water and bucket spun together, the water surface curvature was greatest.

This is how Newton refuted that space and its reference points can move about.

Newton's notion of absolute, stationary space attracted criticism in part because no one could see this reference grid - only relative motion could be observed. However, for a while at least, the far off stars provided fixed reference points for anchoring such a reference grid, and **Newton's laws were found to hold, not only for now, but also backwards and forwards in time** as well, as the Earth's rotation gave good predictions of astronomical events spanning millennia.

Alternatives to a Fixed Space

In 1883 the Austrian physicist **Ernst Mach**, remembered for his studies of supersonic projectiles and their sonic boom [by Mach numbers as multiples of the speed of sound] pointed out that **Newton's references** should not be to an invisible space and time, **but to the visible matter within the universe, with all matter exerting an effect in proportion to its mass and distance away**, so the combined effects of all matter should provide the **inertial reference points** that motion should be measured against.

Motion and Time

But what of **time**? Galileo conducted a simple but famous experiment. He rolled a ball across a table and observed what happened as it fell off the edge of the table. He noted that the ball still had a tendency to continue on in a forward direction, anticipating Newton's law of inertia - but the ball also fell. He found that the distance it fell was predictable by an odd number rule - if in the first unit of time it fell one unit of distance, $d = 1$, then at $t = 2$, it fell $d = 1+3 = 4$; at $t = 3$,

$d = 1+3+5 = 9$; at $t = 4$, $d = 1+3+5+7 = 16$.

[note that this is also $d = T \times T = T^2$].

The distance fallen varies as the square of the time it fell.

How did Galileo measure the time? He had no clock as we know it, so he had an assistant block a small hole in the bottom of a tank of water, and measured time by the volume of water that flowed in the interval when his assistant removed his finger from the hole. This is a **water clock**, where a volume of water represented a time interval. With this clock he could time the movement of the ball across the table in arbitrary units. He could predict where the ball would strike the ground below the table, by calculating the forward speed and the accelerating rate of fall from his measurements - **the distance fallen increases with the square of the time, making the ball fall in a parabola.**

But what if we took photographs at random intervals as the ball moved along the table whilst this experiment took place. We could certainly put the photographs in order of time by the positions that the ball was in at each shot as it crossed the table - we would know the exact distance travelled, but we would have missed a vital bit of information without which we could never predict **WHERE** the ball would strike the ground after it rolled off the end of the table!

If the ball rolled slowly, it would land nearer the table, and if rolled at a higher velocity, it would land further away from the table. Thus the positions, without a time, do not give the whole description of the movement of the ball. **But we can never measure time** - all we can ever do is to measure other events that appear to **also** flow evenly with time!

This is the problem with time- it can never be measured directly.

Recently, some people, such as Julian Barbour, have claimed that there is no such thing as time. But for the rest of us time is more real. Thus, **light** [in a vacuum only] travels at a fixed **velocity**, that is, a fixed distance [300,000 km] in a fixed time [1 second]. All electromagnetic radiation, including light has a frequency and a wavelength, such that **frequency [as cycles per second]* wavelength = velocity of light**. If light had a constant velocity, then time could be measured indirectly, but very accurately.

The Mysteries of Light

Some effects of light, such as the darkening of silver salts, seemed to show that light was the effect of **particles**. For instance, increasing the rate [intensity] or the time of exposure built up the effect. But light was a mystery back in 1802, when Thomas Young investigated **interference** effects of light. **Thomas Young** was famous for his deciphering of Egyptian hieroglyphs on the Rosetta Stone. He found that light from a source passing a single slit gave the expected brightest band in the centre and intensity falling off on either side. However, when this light from a single slit was then passed through another screen with two parallel slits near each other, then **bands of bright and dark fringes** appeared on a target beyond the two slits. **He interpreted this in terms of a wave theory of light**. He deduced this by analogy with the behaviour of water waves, with interference between the waves spreading from each opening to cause enhancements at peaks and troughs,

and cancelling each other out where a peak from one ran into the trough of the other.

The Frenchman **Augustin Jean Fresnel** built upon this notion. There was a generally accepted notion at that time that light waves must travel through an elastic medium called the **aether** to transmit this vibration. The aether would also act as the fixed space reference for Newton's laws of motion. Then in 1831 **Michael Faraday**, an English scientist, discovered **electromagnetic induction**. He showed that electricity and magnetism were related phenomena, and introduced the **notion of lines of force and magnetic fields** after producing patterns by sprinkling iron filings on paper over magnets.

The Scottish physicist **James Maxwell**, in 1855, developed Faraday's qualitative field notions into mathematical form, and showed that electromagnetic effects should propagate through empty space at a speed determined by a certain constant that had already been noted was the same as the speed of light. **Maxwell's equations proved that light was an electromagnetic effect**. In 1888, **Hertz** confirmed Maxwell's theory by detecting the waves from an electromagnetic source.

[This is the end of Part 1 of John's article. The concluding Part 2 about *The Speed of Light* will be in the January 2003 issue of Prime Focus.]



Our Trip Around Australia

by Ursula Braatz

My husband and I arrived at Coonabarabran on 1st July where we settled into a caravan park, then drove to the Warrumbungle National Park and visited the Siding Spring Observatory. I was amazed how big it was.

First we went into the display room where there are lots of posters of galaxies, star clusters, planetary nebulae, other Messier objects and quasars. I have seen the Tarantula Nebula in the LMC and the globular 47 Tucanae near the SMC in my telescope, but the pictures in these posters are amazing. It even showed single stars in the LMC.

Then we went to see the observatory itself, a short uphill walk. A lift took us up inside the dome to a viewing platform where we could see the 3.9 metre scope through a protective screen.

On 2nd, we went to Moree where at night I watched the Sickle Moon and Jupiter in the west. For the next five nights as we travelled north, light pollution from the caravan parks only allowed us to watch the Moon and Jupiter.

For the next three weeks we had a great holiday travelling north to Mt Isa then across to Northern Territory, visiting Katherine (and its Gorge) then on to Darwin. At nights I was only able to watch Jupiter and the Moon, plus Mars. Star viewing was difficult because of air moisture and caravan park lighting.

At Darwin, we talked to people about astronomy. Someone asked if they could see the seven sisters. I said they could, and Orion and Taurus, if they got up in the morning.

In 26th July evening while at Litchfield, I tried to see Jupiter, Mercury and Regulus, because Mercury and Jupiter were only 0.5° apart. I saw only Jupiter and Regulus. As it was only 45 minutes after sunset, it was probably too light to see Mercury.

On 27th at 6.00am I saw the bright sickle moon rising, two days before the New Moon. Then that night the starry sky was perfect. The Milky Way was shining brightly and I could see the dark lanes. The moist air seemed to make the stars bigger and brighter.

On 31st July, while in Kakadu, I watched Mercury, Regulus and the moon make a lovely triangle.

We then set out on a round trip towards home, via Western Australia. We visited Kununurra, flew over the Bungle Bungles, stopped at Fitzroy Crossing and drove through the Kimberleys towards Broome. On the way south-west down the Great Northern Highway, the desert was all red sand and stones. I thought, this is what Mars must look like, but lifeless.

We eventually arrived at the Eighty Mile Beach caravan park and stayed for a week. The West Coast is different from the East Coast, the sea is light blue-green and calm and the sand is mostly red. It is like you are in another world.

Here I saw the most beautiful sunset every night. Other people were sitting on the beach and watching the sunset also. The last piece of Sun became flat and looked like a thick dish at last. The sky over the horizon was beautiful orange before and after sunset and in the east the horizon was dark blue.

On 12th August I watched the Full Moon rising orange-red and Mars rose after the Moon and the air at the horizon made it shining brighter. I knew the Moon and Mars were close together the next night. We were talking to other people and I said "I am going to watch the moon rise now." So the people came with us and watched too. There the Moon rose beautiful orange and when it was in the sky I said Mars should be there too. After a while a lady said "there is Mars" – she saw it before me. It was a little bit under the Moon on the right side.

Mars was in the full orange glare of the Moon but still shining by itself. Both the Moon and Mars looked great all night. I got my telescope out on 14th August and because Mars rose first I had it in focus with the first eyepiece. I tried the second eyepiece and because the Moon was already there, I watched it instead of Mars. It looked like there was a fire on the edge of the Moon. The air in Western Australia makes for some sort of illusions.

On the road again, we travelled south to Cape Keraudon at the Shire of East Pilbara. At night I watched Mars again with my telescope, and finally had it in focus with my second eyepiece. It looked a bit less red and there was a black dot on it. Maybe it was an illusion or a dark area on Mars. There was a nice starry sky again. The Milky Way was high up in the sky with the Southern Cross and Scorpius. I observed the Jewel Box through my binoculars.

More travelling via Karatha, Exmouth, Carnarvon, Geraldton, Perenjori, Kellerberrin. I did more Mars observing when I could, but didn't see that black spot again.

On 1st September, we dove over the Nullarbor Plain and by the 3rd we'd gone through Ceduna, then Wudinna where we stayed the night. Here at Eyre Peninsula the area is nice, with the trees higher. The sky was clear at night and it was a Half Moon. After observing Mars again with the telescope, I tried to observe some stars and got the Jewel Box in focus – it looked great.

Besides seeing the Pleiades in the morning, I did not observe other star clusters on the trip. I should have tried harder but because of seeing so many things on the road, I was tired at night.

On 4th September, we entered NSW and stopped at Broken Hill. Then it was a drive via Cobar, Nyngan, then over the Blue Mountains, stopping at Bathurst. We arrived home on 7th September. It was a good experience and we know a lot more about this country now.

Ursula Braatz

[I'd say it's a case of "I've been everywhere, man." Ed.]

2004 Annual General Meeting

This is to give early notice that the 2004 AGM will be held on Monday 19th April 2004.

Nominations for all office bearers will be received from the February Meeting through to the March meeting.

Maybe you would like to be on the committee?