MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal

PRIME FOCUS

Volume 2 Issue 10 **November 1997**

MAS : Postal Address PO Box 17 MINTO 2566 Phone (02) 9605 6174

Contents of This issue

Astronomy 98 will soon be available at society rates for those who wish to purchase the yearly astronomical almanac. The cost will be $14.00. I am only purchasing limited copies so **be quick** and save $3.00. In order to have your copy in time for the new year, and so as to simplify book keeping, please hand your money to Phil, Noel or Eric at the November meeting, or **mail it to the MAS post box by 23rd November.**

President's Report

It was great to receive our society telescope. Special thanks to Terry Storey of York Optical, The Commonwealth Bank for the generous donation and Noel Sharpe for organising the whole event. The 6" scope according to Bob is excellent for viewing and quite easy to use. This was amply demonstrated at the Camp where every one got a go at pointing and looking through the telescope.

The committee still has to work out a simple instruction handout and short orientation on how to use the telescope for those members who wish to borrow this piece of valuable equipment. Also a short form will be drawn up to sign for users so that we are covered if any damage was to occur whilst it was being borrowed. Let's hope it gives many of our members great satisfaction in viewing the night sky

We are particularly pleased and privileged to welcome to tonight's meeting Dr Paul Butler, Staff Astronomer from the Anglo-Australian Observatory. Dr Butler will speak to us on "The Discovery of Extra-Solar Planets".

Important Dates:

6th December – Star Night – Burragorang Deep Sky Site: This site has an incredibly dark sky with no obstructions. (Ring Phil or Noel for details).

7th December – Christmas Picnic: Sunday, 12:30 – 1:00 till whenever. Our picnic will be at my place. Please bring food and drink as it will be a BYO BBQ and pool party. See me (Phil Ainsworth) after the meeting or ring for details.

19th Jan – 1998: Come to our opening meeting for the year and hear Frank Drake of SETI fame. (This is still to be confirmed but we have every reason to be hopeful he will attend).

21st-23rd January-- SETI Conference:-- Brochures available at meeting.

Easter-- 10th-13th April -- XVIII National Australian Convention of Amateur Astronomers-- Details about convention at MAS meeting.

28th February-- Fees due-- see one of the committee for cost. Please pay before this date. There will be a $5.00 optional extra available (to cover postage costs) for those who wish to have the Journal mailed to them if they miss a meeting, so they can keep up with what's happening. When you renew membership, be sure to indicate on the renewal form if you wish to take up this option.

16th March-- AGM with short astronomical talk to follow. (Subject and content yet to be arranged.)

27th-30th March, 1998 South Pacific Star Party-- See Phil for a brochure at the next meeting. (An event I believe not to be missed by any keen amateur astronomer).

Latest News--

MIR Space Station: MIR is now operating at 90% efficiency as the Cosmonauts repaired the damage to the Spektre Science module and damaged solar panels. Andy Thomas, our very own Australian Born Astronaut, is scheduled to live on the station for four months early next year.

Cassini: Cassini is finally on safe passage to Saturn-- The spacecraft was delayed due to court difficulties as it is carrying plutonium (nuclear powered fuel cells) to give it sufficient energy to make the voyage as the Sun is too far away to power solar cells. The spacecraft will obtain gravity assistance from Venus (twice) and Earth (once) during its seven year voyage. It will arrive in 2004 and send down a small probe called Huygens onto the surface of Titan (Saturn's largest moon). The probe holds special meaning for myself and almost one million other people who have their signatures inscribed on a CD which the spacecraft is carrying.

Apollo 11-- Lunar Landing Mission

Apollo 11 was launched from Cape Canaveral 13:31:01 GMT on July 16th, 1969. After 2 hours and 33 minutes in orbit around the Earth, the spacecraft set off toward the Moon.
On arrival at the Moon, the spacecraft was placed in an elliptical orbit. The Lunar Module (LM) with Buzz Aldrin and Neil Armstrong was undocked, and after a systems check headed towards the surface of the Moon. This left Michael Collins to pilot the Command Module in orbit around the Moon until the other two safely returned.

Neil Armstrong was the first to leave the LM on July 20th (US) and step out onto

the Lunar surface and say these immortalised words " One small step for (a) man, one giant leap for mankind".

The two astronauts quickly carried out a planned set of sequences that included deployment of a Solar Wind composition experiment, collect Lunar material and take some panoramic photographs of the Lunar region. Other scientific equipment was setup to record Moonquakes and other events.

After 2 hours 15 minutes on the surface, the astronauts slept in the LM. The LM finally left the Lunar surface after 21 hours. A successful docking with the lonely CM pilot and off toward Mother Earth for a safe splash down.

Man had finally left the cradle and had become truly a spacefaring civilisation.

Phil Ainsworth ■

Notices

- The Committee is asking members who have been given **name badges** to please wear them to meetings. With so many new faces, it's hard to remember all those names. Also, the Committee is working to issue name badges to those who don't have them.

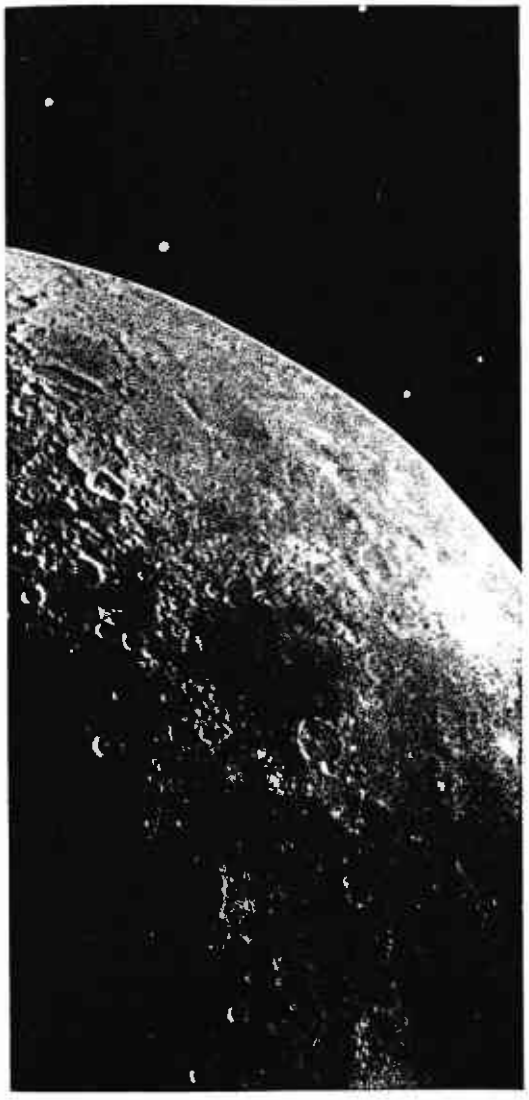
- The Society will still be having **observing nights over the holidays**. Please contact Noel Sharpe on (02) 46253051 for details of dates and locations.

- **Nomination forms** for the Election of Society officers are available at the door or on request. Please consider nominating for Committee and also nominating members for the positions of President, Vice President, Secretary, Treasurer and Committee Member. Nomination should reach the Secretary by end of February.

Danger Thin Ice!

An article from Nature, Volume 386, about Europa, the potential life bearing moon of Jupiter, says that the size and depth of craters in the surface ice crust suggest that the ice is less than 10 million years old.

This implies 'recent' geological resurfacing of Europa, as it is considerably less than the age of the Solar System (4.5 billion years). This has led to various theories of the outer ice sliding over a deep ocean. ■



What's To See This Month?

A Plethora of Planets.

It's another busy month (or months) for the planets.

Mercury makes its appearance in the evening sky, best observed at the end of November and the first week of December. On 18th November, I sets at 9.17pm (Summer time), its latest setting time being 9.45pm on 30th November, when its mag will be –0.4.

During November, mercury will be progressing from Ophiuchus to Sagittarius.

After 17th December, Mercury will be a morning twilight star, appearing initially in Sagittarius.

Venus will be bloomin' spectacular during November and December. (To remind us of the Christmas Star, perhaps?)

From 25th November, at mag –4.6 with a diameter of 31.74" of arc, it goes to 25th December as mag –4.6, diameter 50.73" (Huge!). This is about 3/100ths of the apparent diameter of the Moon. Very respectable.

Venus will be keeping many appointments with various other objects during this period. It will be 3° from Neptune on 8th December, about 0.5° from M75 (a globular cluster) on 10th December, and on 22nd December, Venus and Mars will be within 1.1° of each other. Can it be love?

Venus reaches its brightest (this time round) at –4.7 mag on 12th December.

Mars follows his girlfriend Venus into Sagittarius during Nov/Dec but is a definite 2nd fiddle with its humble 1.1 mag and 4" arc diameter. But Mars is having its own flirtations (does he take them to a Mars bar?) with globular clusters M28 (0.3° on 16th November), M22(0.6° on 20th Nov.), M75 (0.5° on 17th Dec.) and other planets Uranus (0.6° on 27th Dec.) and Neptune (1.6° on 16th Dec.)

Jupiter – From Nov. to Dec., Jupiter becomes slightly less bright going from –2.3 on 15th Nov. to –2.1 on 15th Dec., also losing size of diameter (38.8" to 35.8"). However, it will still be high during the evening and easy to watch.

By 30th Dec. it will be setting at 10.45pm (summer time). Don't miss this opportunity to observe Jupiter in Nov/Dec, because after December, it won't be visible again until March 98, appearing in the morning sky.

Just out of interest, if you like to observe Jupiter's 4 Galilean moons, form the charts provided in Astronomy 97, you can pick nights when all 4 moons will be on the same side of Jupiter (East or West) from our viewpoint. eg, this will occur on 18th Nov (West), 23rd Nov (East), 3rd Dec (West), 7th Dec (East), 17th Dec (West) and 29th Dec (East). Adds another dimension to watching that beautiful planet.

Saturn will be visible in the NW sky, very high, and sets very late in the morning, so is quite viewable at respectable hours, at mag 0.4 (Nov) to 0.6 (Dec) and diameter 19.4" (Nov) to 18.5" (Dec).

Saturn's main claim to fame at this time is its occultations (No! – it's not playing with a Ouiji board) with the Moon. At our latitude, we don't get to see Saturn actually pass behind the Moon, but it still gets very close. Eg On 10th Dec, Saturn is seen 2.8° from the Moon at 10pm (summer time). Why not keep a record of Saturn's encounters?

Uranus still viewable at mag 5.8 in Nov/Dec, setting at 9.45pm (summer time) on 30th December.
Its location on 29th November will be 20h 32m 38s, -19° 27` 26``, and on 27th Dec. 20h 37m 47s, -19° 08` 01``.

Neptune is mag 8 in Nov/Dec, setting at 9.20pm (summer time) on 30th Dec. It's location on 29th Nov. is 20h 59m 43s, -20° 12` 46``, and on 27th Dec. is 20h 03m 24s, -20o 02` 38``.

Finally - don't forget to watch for that spectacular but elusive object Clausus Reindeerus. It's expected to be seen about mid-night over every chimney in town (something to do with a disruption in the space-time continuum) on the 25th December.

Happy Christmas and Good Seeing

Bob Bee ■

Uranus and Satellites. Uranus and its five major satellites; images by Voyager 2 in 1986.
Photo by JPL/NASA.

DR RACHEL WEBSTER AND 'THE ULTIMATE FATE OF THE UNIVERSE'.

On 23rd October in Lecture Theatre 6, the UWS had as its special guest, Dr Rachel Webster, a professional astronomer from Melbourne University.

Dr Webster presented a fascinating lecture on the Ultimate Fate of The Universe, with a special emphasis on Quasars and Gravitational Lensing which are her personal specialities. A small number of MAS members attended, along with staff and students from UWS.

Dr Webster outlined the brief timeline of the 'new' astronomy:

- 1930s – Hubble's law
- 1960s – Discovery of Cosmic Microwave background radiation
- 1979 – Discovery of first gravitational lens. Led to a mapping of the mass of the universe
- 2000s? – model of the Universe.

She explained the mechanics behind the two possible endings of the Universe:

- continue to expand forever…
- stop expanding and start to contract into the Big Crunch'.

Without allowing for dark matter, current estimates of the mass of the Universe suggest it is about 100 times short of the amount necessary to stop expansion.

However, it is also estimated that about 90% of the mass of the total universe is in the form of dark matter – *whatever that is!*

Dr Webster went on to discuss and show with slides and a bench top optical demo the phenomenon of Gravitational Lensing. All in all, a fascinating and informative lecture.

Bob Bee

Cosmology Models: From Deities to the Big Bang, Or Plasma Continuum – Part 2.

By John Casey

The Big Bang:

In 1929 Lemaitre proposed the first version of the modern Big Bang theory. He proposed that the universe was closed both in space and in time. Again utilising thermodynamic principals- that entropy is everywhere increasing, he proposed that the number of quanta [-individual particles in the universe] is increasing, soaking up the available energy, so that at time zero there must have been one single particle- a vast primeval atom of zero radius. He justified this approach on the extreme high energy of cosmic rays- which he believed were beyond the energy capable of being developed in stars,- so they must have come from this Big Bang. The Big Bang could also explain the large amount of helium in the universe, as well as the expansion. Our own galaxy could only have produced about 1-2 % helium from the fusion of hydrogen in stars over the last 20 billion years, well short of the 24% that appears to be uniformly distributed throughout the universe, based on spectral abundance, and a Big Bang could account of this.

The Big Bang and the A-Bomb:

In 1946, George Gamow, one of the Manhattan Project scientists who developed the atomic bomb, reasoned that if an A-bomb could create new elements [that could be detected in the desert years later], in a time period of 10^-8 seconds, then why not create the elements in the Big Bang, billions of years ago. In 1947 he wrote "One, Two, Three, Infinity", with the last chapter presenting the Big Bang as accepted fact. But at the same time, in 1946, Hoyle put forward a theory that heavy metals were formed by gravitational collapse of stars as hydrogen fusion ran out, either by fusion, or, by the same neutron capture mechanisms that Gamow proposed for the Big Bang. Things get a bit more detailed now in attempting to show what is supposed to have occurred.

Big Bang Time Frames:

According to modern cosmologists, with some improvements over this original Big Bang theory, the universe began between 10-20 billion years ago as an immense explosion as a ball of energy of unbelievable strength expanded. From a perfect state of low entropy and symmetry an asymmetry in time and space initiated this "Big Bang". On the assumption that physical laws that exist now applied since then, physicists have worked backwards to describe the conditions that existed at various points in time after this "Big Bang" had begun. Thus the epoch of perfect symmetry[supersymmetry] existed before 10^-43 seconds, with temperatures exceeding 10^32 K. Like high temperature steam expanding and cooling, and undergoing phase changes as it cools and condenses firstly to liquid [water], then to solid[ice], this fireball of energy first condensed out gravity as a long distance force at 10^-43 seconds, and 10^32 K, then there was a separation of the strong force that, through Gluons would overcome the strong repulsion of like charges that allows the nucleus of atoms to hold together. This occurred at 10^-35 seconds and at a temperature of 10^28 K.

Then there was a separation of subatomic particles called quarks and leptons. At about 10^-12 seconds and

10^16 K, there is separation of the weak force. This is the force that is responsible for radio active decay of unstable atoms. It and the strong force have a very short working range, about 10^-15 M, or about the diameter of a nucleus of an atom. These forces had vastly different strengths and fields of effect. Gravity was by far the weakest force. For two electrons, gravitational attraction is 10^42 times weaker than their electromagnetic repulsion, but it is a long range force that is always attractive, whereas electromagnetic forces can be attractive or repulsive. Although electromagnetic force is also long range, the force only acts on charged particles and diminishes in strength as the inverse square of the distance between the charges. Gravity affect all particles with a rest mass.

The weak force is a hundred million times weaker than the electromagnetic force, and is neither attractive nor repulsive; but the strong force is a thousand times stronger than the electromagnetic force, and can be attractive or repulsive. The weak force affects angular momentum, and is left handed, so when a nucleus decays and emits an electron, the electron is preferentially pointed in the direction of motion, like a left -handed screw thread. A positron, emitted in a decay, is right handed!

As the universe continued to expand and cool, more phase changes occurred. At 10^-5 seconds, and 10^13 K, the subatomic particles/forces allowed protons to form. One of the later versions of the Big Bang theory is called the Grand Unified Theory [GUT], and it attempts to model the universe in terms of unifying the effects of the strong, weak, and electromagnetic forces, and makes predictions about the energies of particles on the order of ten million trillion Ge V. According to this theory, protons and electrons were equivalent at very high energies, and should be in equilibrium at these temperatures. Thus a proton should result when pions and positrons merge. At lower temperatures the protons should slowly decay back to pions and positrons, which in turn break into quarks, releasing large amounts of energy.

As well as making normal matter, the theory requires that equal amounts of antimatter be formed. If, as required by symmetry, matter and antimatter are formed throughout this brew and in equal quantity, then, as expansion continued, all matter and antimatter would annihilate each other, and only energy would remain. However, if some excess of positrons turned into protons, there would be an excess of protons and electrons left over after all the antimatter had been annihilated with which to form the universe as we know it.

Unstable Protons:

The problem with this theory is that it requires interchangeability between protons and positrons at high energy, which in turn requires that the proton be unstable, and subject to decay. The GUT theory predicts an average lifetime of 10^30 years, but experiments done so far have shown that protons don't decay at even hundreds of times this lifetime. The decay of protons is crucial for the GUT theory, and it is crucial for the Big Bang according to this theory. Anyway, continuing on with the predictions of the Big Bang theory, hydrogen , as the simplest atom was formed first, and helium would then start to be formed at 250 seconds after the bang, with the temperature now down to 10^9 K.. Up to this time, the

brew of electrons and photons and other particles kept scattering the photons and bouncing them back into the brew. The ball of energy was not transparent, so particles were "rubbing shoulders" with neighbours, and no radiation was lost to them-all were bathed in a sea of light.

However, at the next phase change, at 2X10^13 seconds, or 700,000 years, and a temperature now down to 4000 K, the electrons were absorbed into formation of atoms with the protons to form hydrogen and helium, and the free movement of electric charged particles declined significantly, as the electrons were now constrained within atoms. As this happened, a decreasing number of charged particles were present to scatter the photons. This meant that the universe suddenly became transparent to photons, so they could travel in straight lines, without being scattered. This burst of light from the cosmic background radiation then leaped out ,at the speed of light, in all directions. The newly forming atoms, with mass to slow them down, could not expand at this rate, so the light raced ahead to signal the event.

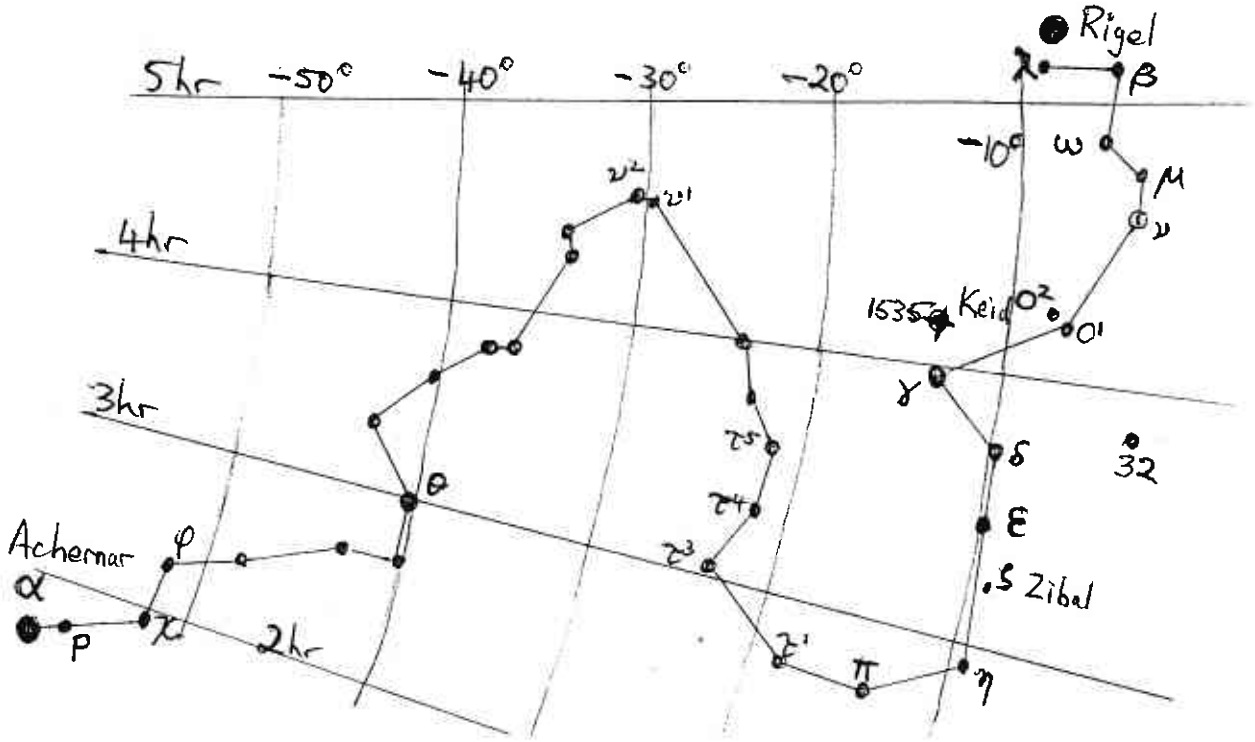
Even as this freshly formed matter expanded, the tiny but constant pull of gravitation tugged at the outward expansions, and local inhomogenuities became the centres of increasing concentrations of mass. Soon, as the distances between atoms became large, and the other forces lost their effect, this mutual attraction became dominant and the atoms precipitated into increasingly more dense dust and gas clouds. Most of the atoms were of hydrogen, the simplest and lightest of the elements, with some helium also present, but very little heavier elements. But the small differences in momentum and direction began to compound into large effects as the clouds collapsed to form protostars. The clouds began to spin faster as they collapsed inward. Small masses of gas and dust formed into spinning spheres, that grew in size, and a solid core developed. As the size of these bodies increased, so did the densities at the centre, to resist the ever increasing pressure of the mass above.

This contraction released gravitational energy, raising the temperature at the core. Eventually , when the body was large enough, and dense enough at the core, this central core heated to temperatures of millions of degrees K. This was enough to initiate the fusion reaction of hydrogen into helium. The fusion released large amounts of heat, which caused higher temperatures,- and the increased thermal agitation caused expansion sufficient to counter the relentless gravitational compression. This heat output radiated and convected towards the surface, establishing an equilibrium and sustained rate of fusion at the core. The heat that reaches the surface of the ignited star was then radiated as light, with the energy of the fusion reactions in the core supplying the energy being radiated. For the Sun, the core temperature is of the order of millions of degrees K, but, with the very large area of the outer photosphere to radiate this energy, the total power of the light emitted is that of a black body emitter at 5800 K. Because the Sun does not emit as a perfect black body, the maximum light flux occurs at 460 nanometres, corresponding to a black body temperature of 6300 K, with a luminosity of 3.82 X 10^26 watts.

John Casey ■

This is the second part of John's Multi-part epic. Stay tune for Part 3 in 1998.

Eridanus – The River



This constellation meanders like a river (surprise!) across 60° x 30° of sky. Unfortunately it's as faint and indistinct as it is large. It stretches from Orion to Phoenix .

However, it contains some interesting multiple stars and a nice planetary nebula, so it's worth the study. The reason I've picked it is because at this time of the year (Nov/Dec) it is nicely placed for viewing from our latitude – almost directly overhead at 9pm, and more so even later at night.

So, what can we catch in the River?

α **Eridani** ('Achernar' – the river's end) is the brightest star at mag 0.5. It's also the *9th brightest* star in the sky. Though not spectacular, it is a blue-white star 91 l.y. away. (1hr 38m, -57°) and can be one of the landmark stars to help you find your way about the sky.

β **Eridani** ('Cursa', the foot stool. Now that's quaint. You will notice that Cursa is immediately beneath Rigel, which is Orion's ankle or foot – hence the foot stool. At least it can be found this way.) It's a blue-white giant, mag 2.8, 78 l.y. away. (5h 8m, -5°). You will note the obvious:– α and β are at the extreme opposite ends of Eridanus.

ε **Eridani** is the *10th nearest* star to us, at 10.7 l.y. away. That distance is interesting because, being close to 10 l.y., by definition of magnitudes, it is effectively the same absolute magnitude as its apparent magnitude of 3.7, which makes it a similar class star to our Sun, a yellow dwarf. It is suspected to have a large planet or small star as a companion and has also been a candidate for SETI study. Unfortunately, ET's phone appears to be off the hook.

θ **Eridani** is Acamar, a nice pair of blue-whites of mag 3.2 and 4.3, about 55 l.y. away. A small telescope should divide these easily. (2h 58m, -40°).

o^2 **Eridani** is a stunner. Also called Keid or 40 Eridani, it is 16 l.y. away. It's in fact a triple! Here's a chance to easily gaze upon a white dwarf, the 9.6 mag companion to the main yellow 4.4 mag primary star. Both are easily seen in a small telescope. But there's more. A small telescope will also show a 11th mag red dwarf companion to the white dwarf – triplets! (4h 15m, -8°).

32 Eridani is a colourful double, suitable for small telescopes. It has a 4.8 mag orange giant and a 6.1 mag blue-green. 290 l.y. away. (3h 54m, -3°).

p Eridani is a wide pair of beautiful mag 5.8 and 6.0 orange stars, 22 l.y. away. These stars take 500 years to orbit each other. (1h 40m, -56°).

and last, but not least...

NGC1535 is a nice challenge for small and medium telescopes. 2000 l.y. away, it is a small 9th mag planetary nebula. It can be seen with small telescopes, but you need a MacDob size scope (150mm) to really see the blue gray planetary disc. (4h 14m, -13°).

Hopefully, this is one river that won't drive you around the bend.

Bob Bee ■

Answers to Earlier Messier Quiz:

Q: Name two constellations without either Messier or Caldwell deep sky catalogued objects.

A: Aries and Libra.

Q: Is it possible you could view all 110 Messier objects (actually 109 as M102 isn't catalogued) on one night? If so, where and when?

A: Yes. In late March to early April in the Northern Hemisphere.

Vice President's Report

The year is drawing to a close and one pauses to reflect on a great second year for the Society. However, onwards and upwards to next year.

In the interests of our membership, several items are currently being looked at:

- Change in room and day of our monthly meetings at UWS Macarthur.
- Posting out of Prime Focus to those not at monthly meetings.
- Society telescope available for observations at monthly meeting.
- Every month an observing night at Wilton or Burragorang alternately.
- Hands on assistance to members who borrow the Society's telescope.
- Change in format of Prime Focus to lessen workload.
- Statement of Society's finances in Prime Focus.
- Regular raffles to be held to boost funds. i.e. to purchase eyepiece etc.

As you can see, lots of things to consider. A real concern of mine is the low attendance at monthly meetings and observing nights, so maybe mailing to the membership is the way to go. Rather than impose an increase in membership fee to all members, a small increase for those who opt to avail themselves of mail Prime Focus (when they miss a meeting) is proposed. If members know what's coming up, I'm sure attendance will improve.

With regular monthly meetings and field nights, there will be two opportunities to attend gatherings each month and I look forward to seeing you.

Kind Regards
Noel Sharpe --Vice President ■

NEWS BITE

Steady State Theory – The Sequel?

It is normally expected that when quasars are found in close pairs, that they are physically associated. One would expect them to have similar red shifts. However, n 'Astronomy & Astrophysics', Vol 320, Fred Hoyle, Geoffrey Burbidge and peter Scheider have reported they found different red shifts for the components of four quasar pairs.

They have eliminated the possibility of the 'pair' being caused by gravitational lensing, and the odds are against the technical possibility of one quasar 'magnifying' the light from a more remote (and therefore having greater red shift) quasar.

What they have proposed, however, is that a large component of the red shift is caused by something *not related* to the expansion of the universe. (This would be consistent with the observed quasar pairs). If this was so, then it could be reasoned the red shifts of distant objects *doesn't* mean the universe is expanding. Ergo, the Steady State Theory might be reborn!

Getting Started – Part 3

Declination and Right Ascension. Fearful terms aren't they? But these parameters are very useful things indeed.

The Celestial equivalents of Latitude and Longitude, they provide a reference grid enabling us to accurately specify the position of any celestial object.

Before we examine how this is done, we need to understand a bit about our viewing platform.

Our Earth orbits the Sun taking a year for a full revolution, whilst at the same time is rotating once a day, right? Well almost right... but more of that later.

Some of these factors are fixed, some depend on the reference used.

The upshot of all this is a new time scale, Celestial time or Sidereal time...

Earth's rotational axis is, at least in human time scales, a 'fixed', and so are its rotational and orbital periods. Our axis, the spindle imagined by a line extended through North and South Poles and out into space, maintains a constant angle to the Universe, regardless of the time of day or season of the year.

This means that one half of the Celestial grid, the equivalent of Latitude, can be just that. Declination is like our Latitude lines drawn on the inside of the Celestial Sphere. Stand at the South Pole, look up and see -90°. Stand at the North Pole, look up and see $+90^{\circ}$, the Equator is 0° and at any point in between, the Declination line of something directly overhead is the same as your latitude.

We define Declination then as the angle north (+) or south (-) of the Celestial Equator.
Obviously something this simple won't work for a Longitude equivalent. We rotate relative to the stars, so we cannot have a terrestrial reference frame.

The method used is just like Longitude lines, drawn from pole to pole, but on the Celestial Sphere and fixed in space. This means we will be rotating relative to these lines each day, so our time of day will determine which ordinate of Right Ascension (RA) is overhead.

So far, so good – but there's a problem with this simple plan, and to understand why, we have to take a further look at Earth's motion and our relativity to the stars.

Our standard measure of time is the Solar Day – noon to noon. Because Earth is circling the Sun as well as rotating, each day requires slightly more than one rotation. The diagram shows why this happens and how in the passage of a year we actually rotate one more time than the number of days.

The stars, having no part in our orbital movement, just see our actual rotation, the period of which is some 4 minutes a day shorter than 24 hours.

The upshot of all this is a new timescale, Celestial time or Sidereal time (SI-DER-E-AL : pertaining to stars) and this is used to provide our cross reference.

Right Ascension, our Celestial equivalent for Longitude, is measured from the point in the heavens where the path of the Ecliptic crosses the

Celestial Equator as the Sun travels north for Summer. Called the Vernal Equinox, marking the start of northern Spring, this point is labeled as 0 hours RA. The Celestial Sphere is divided into 24 (hours) and RA increments eastwards at the rate of 1 hour every 15°.

Sidereal time then will tell you which RA Meridian is overhead. 0 hrs RA will culminate at noon on March 21st (Vernal Equinox) or more conveniently at Midnight on September 21st. You can work out sidereal time by adding 4 minutes to your present 24 hour time for every day since then or do what I did, buy a book with a chart.

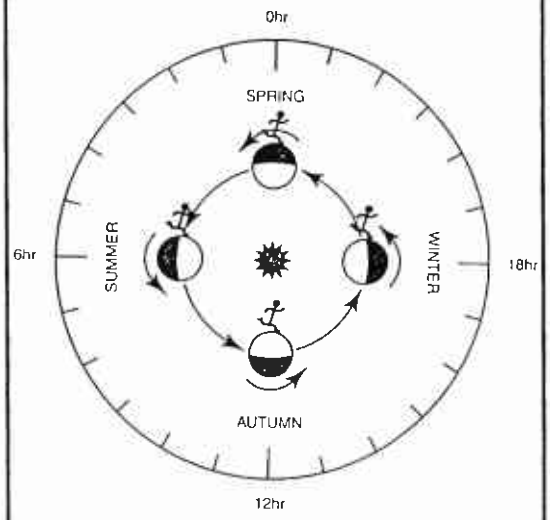
"Tally-Ho! Bandits at 3 o'clock!"

A little experimentation with your Planisphere will give you a better feel for this. Try yourself out by finding which bright southern star has co-ordinates:
RA 06 hrs 23.9 min, Dec –52° 42'.

It is important to visualise this Sidereal 'time' rather as the dial of a clock is used to indicate position – as in "Tally-Ho! Bandits at 3 o'clock!" Otherwise you will be puzzled as to why Europe or the USA see the same stars overhead as we do, although many hours later.

Dick Everett ■

WHY WE GET SIDEREAL TIME



Here we have Earth spinning and orbiting. Time as we know it is measured by assigning 24 hours to the period between successive Noons. As you can see from the diagram, this involves slightly more than one full rotation of Earth but makes good sense in reference to the Sun.

Our little stick man is indicating exact rotations and remains in a constant reference plane with the stars.

A solar day is 4 minutes longer than a sidereal day.

Megatropolis

They say the lights are bright on Broadway, and they would not be wrong. In what would have to be the worst case of light pollution I've ever seen, I give you New York by night.

The journey begins with my desire to make observations of the night sky. However, the only stars I saw were down at NBC studios and stars of a lesser magnitude off Broadway. With all the sky scrapers around, I needed to obtain a high vantage point. The 82nd floor of the Empire State Building would do nicely.

The time was 9pm and in what was rather a thoughtful act, the Empire State Building provided an observation platform for viewing the night sky. Stepping out of the elevator the sight that met me was awe inspiring. I've never seen so much man made light, as far as the eye can see and further, it was simply ablaze. The light pollution effectively erased the sky. Only the Moon, Venus and Jupiter were apparent, as well as aircraft buzzing around like bees near a hive.

New York has three airports and eight million people and to a large number of dwellers, the night sky is never seen. Megatropolis is intensely busy and I don't think there is much time to ponder the heavens.

I thought I would be able to observe at various points I was visiting this holiday. However, staying in large cities i.e. Toronto, Washington etc, the opportunity was never available.

Well, the sleepy one horse town of "Painted Post" looked good, very dark, only a handful of streetlights, if only it wasn't raining.

Views of the other Megatropolises came courtesy of United Airlines. Flying over major cities at night is fascinating. Especially memorable was flying into LA from several hundred kilometres out. It looked like a sunset. Upon closer inspection, the number of motor vehicles travelling on the freeways looked like blood pumping through arteries. White lights in front, red behind, millions of cars. The scale is huge, like 18 million people huge in the greater LA area and Orange County.

The light pollution effectively erased the sky.

New York New York was now left behind, so what memories did I have. Well NY has many, like The Empire State Building, Statue of Liberty, Macys and Bloomingdales, Time Square and Central park. Radio City Music hall, yellow cabs, Bagels and coffee, lots of coffee, Brooklyn and Soho, the United Nations, Manhattan and Harlem. My memories of Megatropolis are best summed up with the following expression:
Wham, Bam, Thankyou Mam!

Noel Sharpe ■

From The Editor's Desk

The Society Telescope:

I was given the privilege of being the first custodian of the Society's new telescope. What type of telescope is it?

It's a Celestron Star Hopper 6, a Dobsonian mounted Newtonian with a 6" (150mm) mirror and a focal length of 1220mm. It comes with a 25mm SMA eyepiece, which gives a magnification of x49. (Work it out – 1220mm/25mm = 49). It has a highest useful power of 360, so when we buy additional eye pieces, a 6mm (giving x200) will be very practical. But we will need extra eye pieces – at least one extra. The Dob comes with a 6x30 finderscope.

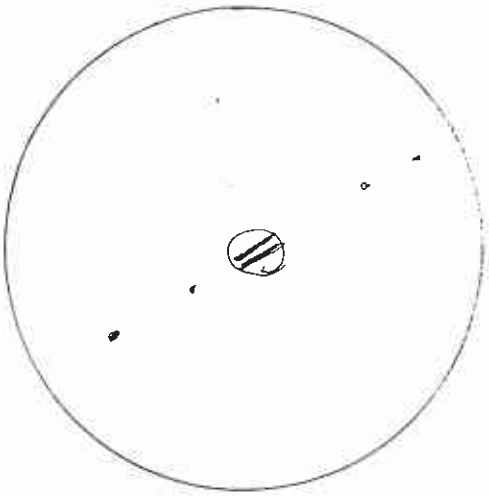
It was fun assembling the telescope and mount, just like a meccano set. And it was actually easy to collimate – I surprised myself. The hardest part was aligning the finderscope. But the best part was giving the Dob its test run.

The Test Run

On Sunday night 26th October, I took the Dob...(we really must give it a name – The Macarthur Dobsonian – MacDob – what do you think?)... I took MacDob onto my front balcony to confront the northern sky. Perchance, Jupiter was almost directly overhead so I aimed in that direction. Unfortunately I hadn't completed the finder scope's alignment at that stage, so there was a bit of criss-crossing involved before I saw anything.

What I saw was a large white circle with a black lolly pop and stick in the middle. Exactly what I saw during the collimation process. What the..? Ah, focus! Turning the focus up, up, up...the circle got smaller, smaller, ...ah! This was marvelous. I had a beautifully sharp image of a white disc with four dots in perfect line. Jupiter and its major moons. Terrific! But wait... as I studied it more, I realised I could see stripes across the planet's surface. Gas clouds! Who would have thought it, with a 6" and only x49 power. You little ripper!

I dutifully made a record of my observation on an Observation Sheet (Ref RB01) the sketch of which is included here for historical purposes.

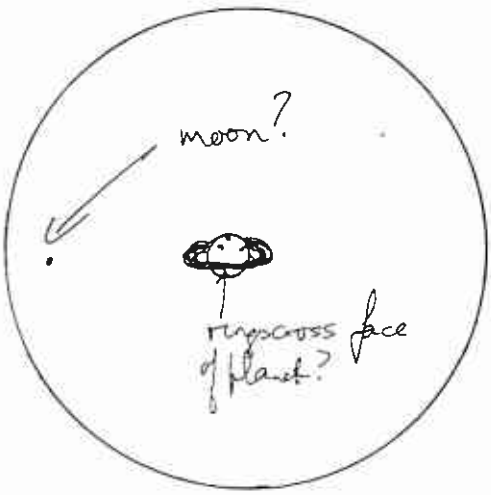


But wait, there's more...

Bristling with success, I turned MacDob (the name grows on you, eh?) on Saturn. Yes, it was up also and conveniently on the north side of my house. More criss-cross fun (I really must get that finder scope aligned) but this time I was already in focus. A black field, but a hint of a glow to the right. Remember to move the scope to the *left*, and ... my wife Marion must have thought I'd dropped the scope, I shouted so loud. "Rings... I've got rings" I cried. "That's nice dear". Ha!

Yes, what I could see was a distinct white circle with jug ears. But closer examination showed the jug ears were

clearly defined and elliptical rings. (OK... **a** ring. I couldn't see the Cassini divisions, but what do you want from a x49 mag?) My recorded observation sketch (Ref RB02) is also shown here. What surprised me was I could actually see where the rings (or perhaps their shadow) crossed Saturn's surface, and I could also see the small gaps on each side between the inner ring edge and the planet.



I also observed a small sharp dot off to the side of Saturn, like one of Jupiter's moons. Could it have been a Saturn moon? Perhaps Titan? I'll have to do some research on that to find out.

All in all, I was amazed with this detail. At that stage, I regretted having only a low power eye piece. What would I have seen with, say, 200 mag? Time will tell.

Thus ended the inaugural viewing session, as clouds quickly moved in. But an auspicious beginning.

Many Thanks

Hearty thanks to the **Commonwealth Bank** for their kind donation for the telescope. And thank you to **Terry Story** for his generous deal from **York Optical**.

For MacDob – the sky's the limit!

Heavens Above!

Following an enquiry to Phil from the Camden Crier, it has been arranged for Phil and I to alternately write a weekly item about the Society and astronomy generally for the Camden Crier.

Phil's first item on 28th October took the form of an In Brief community item informing readers of what the Society was and the things we did.

My first article (on 11th November) was about the spectacular display Venus is currently giving.

Phil followed up with an article about the lecture on 'The Ultimate Fate of The Universe' given by Dr Rachel Webster at the University.

If all goes well and the articles continue, this should be a good form of education for the community and PR for the Society. So look for **Heavens Above!** in the Crier. Only 60c at your newsagent.

Media Goes Starry Eyed

Have you noticed how the major media has been getting on board the astronomy wagon more often lately? There was the giant Solar System Poster in the Sunday Herald on 17th October (pity it showed a picture of a moon for Uranus itself – well, you can't have everything).
Then the SMH ran a front page story about the 'Pistol Star'
Then on 23 Oct, the Australian ran a front page story with colour pictures about colliding galaxies.

It appears the media is finally getting the message – it's a big Universe out there.

Light Pollution

Light pollution has long been a problem for astronomers, but now it has gotten personal.

I used to enjoy a beautiful dark sky from my back balcony in Ruse, trees permitting. But recently the Council installed a vandal deterring 1000w flood light in the lane three houses up. I applaud the Council's action for safety and community reasons. But a sad consequence of this necessary action is that I took MacDob onto the back balcony last night to observe Scorpius and Sagittarius and... I couldn't see a thing! The glare from the security light drowned out half my sky.

Those vandals have a lot to answer for.

Contact

I have just seen this marvelous movie, 'Contact', based on Carl Sagan's equally marvelous book. It is every bit as good as the publicity says, even better if you have a love of astronomy or an interest in SETI.

Just the opening minute is worth the admission price alone. People with a basic knowledge of the structure of the solar system and our galaxy etc. will get a real thrill out of that.

The movie, going 2 ½ hours keeps you enthralled all the way. A great story, mind boggling special effects and something to talk about days later at parties (and star camps with the port).

At the end, as the screen goes dark, the simple message 'For Carl' is shown. I heard voices in the audience murmur – "Carl who?" Sad.

Bob Bee ■

Camp Constellation 6

Despite the weather's worst efforts, CC6 on 8th November was a great success. Miraculously the clouds broke during the evening and the intrepid 20 had some exciting viewing.

The star attraction (pun intended) was the Society's own new telescope – MacDob. It was put though its paces by all present and everyone agreed it gave some great images. What amazed most was the effortless movement on its nylon bearings and the clarity of its optics. Use of borrowed lenses increased its power, but most agreed that on the night, the low power images were very satisfying.

As to the rest of the night (which prematurely ended at midnight due to the return of the cloud cover) it was a perfect demonstration of the synergy of our society. Those present were able to share their experience, sky knowledge, detail knowledge and 'finding' expertise to give everyone the overall benefit.

In this way, over the duration of the night, we were able to: examine Jupiter's moons (one actually went behind Jupiter during the evening); identify Titan beside Saturn; locate Hale-Bopp (mag 6); identify and marvel at M31 (Andromeda Galaxy) – OK it was small and fuzzy in the moonlight, but at least we saw it and know where to look next time; check out 47 Tucanae in MacDob (beauty!) and many other clusters.

The 20 or so stalwarts who attended were able to strengthen friendships and increase their astronomical enthusiasm and knowledge. Let's hope that even more will be able to attend the next Camp Constellation. BB

It Doesn't Get Better Than This

The Society formed a small scouting party to search for an observing site to complement Wilton. Well, we've been successful in that Burragorang is a superb dark site which has the following advantages:

- North, south, west very dark (black).
- Eastern views to Sydney skyline, but dark easterly aspect from about 20° up, then black.
- 360° view on a raised paddock area above the treeline (watch out for the cow droppings). Wear shoes!
- The owner of the property is more than happy to accommodate us well behaved astronomers.
- It's an astrophotographer's heaven. Load up the film, folks, and click those cameras.

As you can see, Burragorang offers many opportunities. From Campbelltown it's about 40 minutes drive on sealed roads, then maybe about 1 km gravel/dirt track to the property. I will confirm the next date at B'gorang elsewhere in this issue. I also believe there is an opportunity to camp over, but please confirm this with me.

The observations I made of 47 Tucanae 'blew me away'. I've personally never seen it so bright. Indeed. The site is dark enough to have clear views to the northern horizon in which the Andromeda galaxy was visible through binoculars. Also the clear surroundings did not permit α and β Centauri to set . They simply lay horizontal to the horizon. In fact all aspects of viewing took on new dimensions.

On the way home, watch out for kangaroos and wallabies. We even saw an echidna (spiny anteater) lazily crossing the road.

As with Wilton, Burragorang is available to members and invited guests. As the privacy of the property owners (for both sites) needs to be considered, the address is not published here. If you are interested in attending, please contact me on (02) 46 253051 anytime. You don't have to have a telescope or binoculars as there's always opportunities to look through the other members' scopes. Indeed, just come along with a chair, sit down and enjoy.

Load up the film, folks, and click those cameras.

You do not have to be knowledgeable in astronomy to attend these gatherings as we love to talk about and show you the things of interest. You never know, you might even see a shooting star or two.

Noel Sharpe ■