MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal
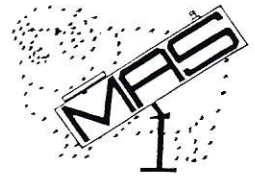
PRIME FOCUS

President's Report

Greetings to all Earthlings in attendance tonight, the universal translator is on line and sends this message "WE COME IN PEACE."

I'm sure you will allow me some latitude, it's just been an amazing couple of weeks since I decided to donate my discovery of a UFO to the UFO society of Western Sydney. The local group of newspapers really ran with the story and I must sincerely thank the representatives of the UFO Society for their acceptance of what was a good-natured intent on my behalf.

The newspaper articles had a suitable dash of poetic license and incorporated headlines like "**UFOs ARE LIT UP BIN BAGS**" and "**ALIEN INVASION? RUBBISH."**
Judging by the initial

interviews I would have to admit to being curious to say the least as to how MAS would be represented, but the opportunity was too good to pass up. In the final wash-up the portrayal of events combined with the colourful media presentation can only add to our public profile.

Educating the general public is a goal shared by both societies. Even though we are different organizations it's important to acknowledge that the person who has a poor knowledge of the night sky will avail themselves of mistaken imaginations.

The planet Venus rising in the morning twilight has bewildered many an early traveller and recently I saw the slowest Shooting Star ever seen, not to mention the ones that glow bright green and split into pieces. The night sky is a dynamic ever changing

place and it's there for all of us to wonder at and enjoy.

Last Month's Meeting

It's a real effort to conduct our meetings within the scheduled time. However, what can we do when so many good speakers are willing and able? Murphy's Law was kept at bay and finally Dr Ragbir Bhathal informed us of the new directions "SETI" is embarking upon. Thanks Ragbir for a great talk. As we have come to expect Peter Druery launched himself into the latest news on the discovery front of which the items on the rotation of Venus and the composition of the rings of Saturn just blew me away. **Keep it coming Peter, great stuff**.

Tonight our speakers will be Dick Everett who unfortunately missed out last month and Phillip Kidd, I'm sure that these two speakers

will add to the great range of topics covered so far this year.

Upcoming Guest Speakers

The following speakers are planned:
September: Don Whiteman, President Astronomical Society of NSW, who will speak to us about collimating telescopes.
October: A work still in progress
November: Dr Russel Cannon, Anglo-Australian Telescope

Upcoming Events:

25/8/01 Public open night at the observatory
15/9/01 Members observing night venue is TBA
17/9/01 Monthly general meeting.

What's been happening?
Several members have been very active indeed and here are some details of their exploits

01/08/01 Japanese Students stargazing night held at Kentlyn.
03/08/01 William Carey Christian School observing.
04/08/01 International House Berrima observing night
18/08/01 Messier Marathon, all night hunt for 100 objects

Well done to all those involved and I look forward to hearing some reports.

Other Items:

Does anyone holds a current **First Aid certificate** and would be able to attend the Open Public nights at the Observatory? If so please see me later.

Our Raffle got off to a flying start and thanks to everyone for your donations, the list of prizes are as follows:
IST PRIZE: Two Plossol eyepieces
2ND PRIZE: Annual subscription to SKY&SPACE magazine and Southern Astronomer
3RD PRIZE: Family pass to the Nepean Observatory
4TH PRIZE: Bottle of fine wine.

Acknowledgements.

York Optical for supplying the eyepieces and of course Terry Story for organising the donation. Jonathan Nally for the Sky and Space contributions, John Rombi for the Family passes to Nepean Observatory and an appropriate supplier for the 4th prize.

At time of writing I've become involved in some extra solar activities and whilst I had every intention of presenting a lengthy report I must however say goodbye and good observing.

Kind Regards
Noel Sharpe

Aperture Fever

First we had Boogie Fever, and then we had Saturday Night Fever. Now standby for the most consuming of all; **"Aperture Fever"**. Over the last couple of years many of our members have succumbed to this "illness". *What is it?* You ask.

The first timer might start out with a pair of binoculars or a small refractor, but after a couple of observation nights looking through someone else's larger telescope the "fever" takes hold. An other wise sound minded person starts thinking how much better the Ring Nebula (M57) or Orion's Nebula (M42-M43) appear, or how much easier it is to see that faint distant galaxy using an instrument of larger aperture. The next question is, "How much can I afford to spend" and so the fever continues. Nights and days are spent drooling over pamphlets and specifications making comparisons between makes and models, and driving family and friends around the twist.

The additions over the last couple of years have been as follows: Noel 8" S.C.T, Lloyd 10" Newt-Dob, Bob 9-1/4" S.C.T, Ian 8" Newt-Dob, Attila 6" Newt-Equatorial, Dick 8" Newt-Dob, Peter 8" S.C.T. and Daniel, soon to be proud father of a 12.5" Truss-Dob. (I've already booked myself in to be one of the first to look through this baby.) All

the above members have served their apprenticeship with smaller instruments and over the years they have graduated to the senior ranks with a scope best suited for their needs. eg, Photography, planetary or deep sky observations.

If you are a beginner my opinion is that you should steer clear of the larger instruments and concentrate on improving your observational skills first, before parting with your hard earned money. I've seen too many people buy large scopes and then become completely confused about how to operate them, and then the inevitable happens and the scope spends its time in the cupboard collecting dust.

I've had a 2-3/4" Unitron Refractor for 30yrs now and I have upgraded its specification many times, and I must say that I'm still amazed by the great images it gives me. You might think that I'm immune from this "fever" but unfortunately I'm not. Currently I'm on a 3yr plan to upgrade to a 12.5" Truss- Dob, but first I have to pass it by the chairman of the board. Ahh such is life!

John Rombi

Brief Note.
Observation Night? 28.7.01

Ha! What a joke. With the wind blowing at gale force the only thing I could see in the sky was a little girl wearing

pig tales and clutching a little dog called Toto.

After Noel spoke with Ragbir, the decision was made to cancel the observation night. Noel and I decided to wait at the bottom of observatory hill from 6.00pm to 7.30pm to catch any eager members of the public that still showed up. Well four people did show up, and while Noel and I were hanging onto their cars and being blown horizontally by the wind, we were told that they had come to look through the telescopes! What enthusiasm! God bless 'em.

John Rombi ∎

Saturn, Moon Master.

In Nice a team of French, Canadian and U.S. astronomers have found **12 more moons** orbiting the planet Saturn. The moons range from six to 32kms in diameter.
This brings the latest count to Jupiter 28 versus Saturn 30.

J.R.

Trivia Question
Calling all trivia fanatics, can anyone tell me what is and where is The Stargate situated? Answer next month. **CLUE: NOT AT CH7.**

Vice President's Report

M.A.S meets The United Nations

On the 4th of August six representatives of the society (Noel Sharpe, Ian Cook, Daniel Ross, Lloyd Wright, Peter Druery and myself) took up the long-standing invitation of The University of Sydney's International House. We all took a trip to their rustic log cabin situated near Berrima in the Belangalo State Forest. Gwen and Brian, the officials of the Uni, and approx 35 undergraduate students who have come from all over the globe to continue their varied studies, greeted us.

After the formalities, we set up our telescopes a short distance from the cabin; unfortunately the observing would not be ideal tonight because of the dreaded full Moon. With the scopes all primed and ready we were called in for dinner. We were tempted with a sumptuous dinner of chicken, salad, and curry with a vibrant cheeky red from Hardy's S.A., (I've always wanted to say that) and our bodies warmed with a roaring log fire. [Plenty of binaries seen that night. – Ed]

After the feast it was time to earn our keep, Noel set up his always-popular slide show and kept the audience mesmerized with the fascination of space for almost one hour. (I don't know how

he does it. What's your secret Noel?)

The outdoor activities were next, with the 30- odd people making a bee-line for the astronomers. Mars, the Moon and the brighter deep sky objects were the stars of the show, but the greatest fascination for our O/S guests, was that all our constellations were upside down to what they were used to in the Northern Hemisphere. This took a bit of careful explaining. The questions came thick and fast and after three solid hours we had 35 new novice astronomers and 6 satisfied M.A.S. teachers.

As if dinner was not enough, at the end of the evening we were all presented with a bottle of red wine and a sincere thankyou for our "show". I know that I can speak for our guys and say what a thoroughly fantastic time we had, and we also learnt a little more about our world from our new friends.

After sorting out a few details, we should hopefully be able to use this site for some of our future observing nights. Keep your eye on this space.

John Rombi   ■

Thanks to Helpers

Noel has already indicated some of the activities our members have been involved with this month. I would like to give a special thanks to

those people in our Society who freely give up their time at these events to help educate the Macarthur community.

So, my heartfelt thanks to Phil Kidd and Ian Cook who, for the second year in a row, joined me at Kentlyn to put on a star display for the Japanese exchange students. I am sure they went home with great memories of the southern sky.

Then, not to be outdone, Lloyd Wright, Mike Fisher, Dick Everett and Phil (again) and Samantha Kidd gave up their Friday night to help me with about 80 year 4 students at Prestons. We had a very clear, if moon glowed, sky and their telescopes and knowledge were greatly appreciated.

Thanks Sam and guys. It's commitment like that which is making MAS a respected society in Macarthur. RB

What Satellite is That?

Earlier, Noel made mention of Venus bewildering many an early traveller. I can attest to that and add how I discovered that one can carry on a simple case of cross-purposes over the meaning of a word for a very long time before the penny drops.

A colleague at work, Fred (not his real name – changed to protect the innocent,) asked me about a bright light he was seeing in the east in the early morning hours from his train

station. (He starts very early.) Before I could say 'Venus', he said "It must be a satellite as it is moving."
"Are you sure it's moving?"
"Oh yes," he said, "and it's very bright."
"Then it might be the International Space Station," I suggested.
Then he floored me. "Yes," he said, "I see it every morning at that time."
I assured him then that it couldn't be the ISS or any other satellite if it's in the same spot each morning. It MUST be Venus because that's where it is these days, and it CAN'T be moving.
"It's definitely moving," he insisted.
"How fast?" I eventually asked.
"Well, it starts at one side of this light post, and in about 15 minutes, just before my train comes, it's moved to the other side of the light post."
(Sound of penny dropping.)
At that stage, I tried to explain the phenomenon of the sky rotating at the rate of $15°$ per hour, or about $4°$ per 15 minutes (the apparent distance from one side of a light pole to the other.)
As a bonus to this revelation of the rotating sky, I gave him a print out of the current ISS schedule and showed him where he could see it at that hour in the morning. "You will see that this is really moving," I told him.
But I had to laugh to myself afterwards about how long we had gone with two different understandings of what 'moving' meant.   RB

What IC this Month
August 20 – September 16

Highlights
Mars visits 2 Globular Clusters. Mercury visible in evening sky. Venus and Jupiter close together in morning sky.

Evening Sky Planets

Mars is visible all evening in Ophiuchus (pronounced 'oh-fee-oo-cuss' according to David Levy) and will set about 3 am. Although smaller in size and slightly lower in brightness it is still brilliant. It will have near misses with GCs 6316 (17/8) and 6355 (21/8) before moving on to the rich galactic area in Sagittarius. On 10-11 Sept. it will be at its closest to M8 and will disturb the shape of the teapot on 16/9 when it will approach M28.

Neptune and Uranus rise before sunset in Capricornus. Uranus is at opposition with its largest disk size and brightest magnitude 5.7. Good eyes should see it without help; for the rest of us it is just 1° from a triplet of stars in a straight line pointing to δ Cap (Deneb Algedi). It will look like a fuzzy star till you get your scope on it. Then it turns green and the hairs on your neck stand on end. At least mine did!

Mercury is approaching its best viewing time in the evening sky. Located in Leo it will move to Virgo for all of September, where on 19/9 it will be at its greatest distance from the Sun. You can see it on 20/8 in the west 30 mins after sunset just 5° to the right from a thin crescent Moon. It will climb higher each night and from 16-22/9 it will be around Spica

Northern Summer Triangle
Is a shape formed by the 1st magnitude stars of **Altair**

(Aquila), **Vega** (Lyra) and **Deneb** (Cygnus). From the south here it is distorted lengthways with Deneb a long way to the north. It rises at the start of the summer season for the north hence its name.

Morning Sky Planets

Saturn remains in Taurus. It will be 6° from Aldebaran in early September then form a triangle with the last ¼ Moon and Aldebaran on 10-11/9.

Jupiter rises before the Sun in Gemini and will just catch the waning Moon on the 13/9

Venus rises after Jupiter in the morning sky. On the 17/8 it will be 5° above a crescent moon and on 23/8 will approach Pollux, one of the twins of Gemini. By end of August and early Sept it will be very close to M44 (Beehive Cluster) in Cancer then cross into Leo on 15/9

Favourite Star this month is Achernar in **Eridanus.** A 1st mag. star the 9th brightest in the sky, Daniel Ross likes it because it helps him find the great Globular cluster Tucanae 47. I like it myself because it's in an area of southern sky with no other bright star. It is the fore-runner to the Cross. When all other 1st mag stars have disappeared Achernar shines alone.

Meteors:
North iota Aquarids are faint and scarce but may be seen late August in eastern evening sky. The Piscids (ZHR 3) are largely unknown but may appear all through September.

Good seeing   IC

Measuring the Distance to the Stars

This is the fourth and final installment of this topic. The three earlier parts covered Parallax Measurement, Spectroscopic Parallax, and Cepheid Variables.

DISTANCE INDICATORS

Deriving an accurate yardstick for galactic distances is vital to all cosmological data. Without such distances, crucial questions about our universe cannot begin to be answered. Such issues as:

* Linear dimensions of the universe
* Spatial distribution
* Intrinsic luminosities and masses of galaxies
* The physical and evolutionary differences between galaxies
* The mean density of the universe
* The universe's rate of expansion
* The type of Cosmological model.

All these depend on a correct scale of distance.

Once we know the distances to the nearest galaxies in our Local Group, how do we determine the distances to the more remote galaxies when parallax and Cepheids fall short?

For beginners, the determination of distances rests on the assumption that similar objects in our galaxy and other galaxies have the same physical characteristics.

Suitably chosen objects can serve as "standard candles" of known luminosity from investigations made of them in our galaxy. The observed apparent luminosity of a recognised "standard candle" in a distant galaxy, combined with the knowledge of its intrinsic (true) luminosity, allows the calculation of the distance to the other galaxy using the now familiar formula

$$\log r = \frac{(m-M) + 5}{5}$$

Different types of standard candles yield different maximum distances to which they can

meaningfully be used to determine distances. See Table RB.5

Table RB.5

DISTANCE INDICATORS		
Brightest of its Type (Standard candle)	Abs Mag(M)	ApproxMax Distance l..y.
RR Lyrae variables	0	1,400,000
Population II red giants	-3	5,000,000
Cepheids	-6	20,000,000
Blue Supergiants	-9	80,000,000
Novae	-9	80,000,000
Globular Clusters	-10	132,000,000
H II emission nebulae	-12	320,000,000
Supernovae	-19	8,000,000,000

For dependability, Cepheid Variables remain the most effective. However, they are restricted in use due to the difficulty in singling them out in distant galaxies. Perhaps with the increased resolution available from Hubble Space Telescope, the new Keck twin telescopes (in interferometric mode) and the VLT in Chile, with absolutely staggering powers of resolution, it will allow Cepheids to be detected in even further galaxies, allowing the 'yardstick' to be re-calibrated and even greater distances re-evaluated for other distance indicators.

Another example using a Blue Supergiant indicator:

The 'corrected' apparent magnitude of an extremely bright blue supergiant star in a remote galaxy is m= +21. From Table RB.5, astronomers know that this type of supergiant has a true luminosity of M = -9.
Thus, we can calculate the distance r by:

$$\log r = \frac{[+21-(-9)] + 5}{5} = \frac{21 + 9 + 5}{5} = \frac{35}{5} = 7$$

Therefore, r = 10,000,000 parsecs = 32.6 million light years.

It gets to the point when individual objects cannot be resolved or identified in a very distant galaxy. We then have to compare the luminosities of the galaxies themselves. Judgements can be made on the basis of the galaxy's total luminosity, its surface brightness, and its apparent size, or its light-to-mass ratio.

Precautions need to be taken when using galaxies as standard candles. One has to recognise the particular class of the galaxy involved (and there are many classes of galaxies) or major errors of scale will occur. A more reliable technique involves examining a large cluster of galaxies and selecting, say, the ten brightest galaxies and determining the average apparent magnitude. This is then compared to the luminosity of the average brightness of a closer galaxy cluster for which we have a 'known' distance. At worst, we can obtain a fair idea of the relative distances to the galaxies.
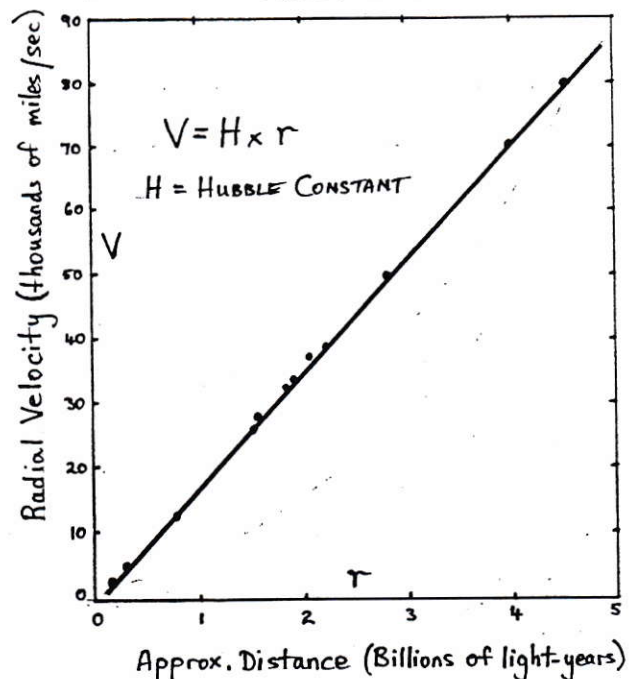
For greater and greater distances, measurements of luminosities and such become inadequate, if not totally useless.

We then arrive at what might be considered the greatest yardstick of all, as well as one of the most significant discoveries in recent astronomical history. Our friend, Edmond Hubble.

One would have to present a completely separate article to do this subject any justice. In this paper, I shall give just the briefest coverage.

Early this century, Slither studied the absorption spectrums of a large number of nebulae and discovered unusually large 'red shifts' of up to 1100 miles/sec (1700km/sec). Even larger red shifts (or velocities away from us) were found for fainter (and further) galaxies by other astronomers. Eventually, Hubble was able to use other methods (as previously discussed) to estimate the distances to some galaxies for whom red shifts had been observed.
In 1929, Hubble plotted the estimated distances against the radial velocities and discovered something marvellous.

Fig. RB.7
HUBBLES VELOCITY- DISTANCE RELATION

$$V = H \times r$$
H = Hubble Constant

Radial Velocity (thousands of miles/sec)

Approx. Distance (Billions of light-years)

That is, the further a galaxy is from us, the faster it is travelling. This became known as the **Hubble Law of Recession** and led to the proposal that the universe is expanding. (Another topic of its own.)
The Hubble Law of Recession can be stated mathematically as: $V = H \cdot r$
where H is the Hubble Constant, the "Holy Grail" of cosmologists.

If you know the value of H, and you can measure V (using red shift), then you can estimate the distance to the galaxy (or whatever object being studied).

So, as you read somewhere that astronomers have discovered a new quasar or some remote galaxy with a red shift of z and therefore is 'x' billions of light years away, it is this simple (?) principle of $r = V/H$ that they are using. All this assumes, of course, that the Hubble Constant H is just that – constant. But is it?

A SUMMARY OF THE DISTANCE PYRAMID

Typical steps from the Sun to the End of the Universe are:

1. Determine the Astronomical Unit.

2. Measure distances to nearest stars using Trigonometric Parallax

3. Use Spectroscopic Parallax to determine distances to further stars.

4. Determine distances to Clusters containing Cepheids. Determine absolute magnitudes of Cepheids.

5. Determine distances to nearby Spiral Galaxies in Local Group containing Cepheids.

6. From distances of these spiral galaxies, determine Galaxy 'standard candles'.

7. Using scaling method, determine distances to farther similar spiral galaxies.

8. Determine average absolute magnitude of spiral galaxies of given shapes.

9. Obtain spectra and red shifts of remote spiral galaxies. Obtain distances by measuring apparent magnitudes and comparing with 'known' absolute magnitudes (from step 8).

10. From red shifts and distances, determine the Hubble Constant.

11. From the Hubble Constant and measured (red shift) velocities, determine other galaxy and object distances.

CONCLUSION:

Let me end this article by saying that the Hubble Constant's value is still a bone of contention. It was initially estimated at about 55 km/sec/megapc. That is, a recessional velocity of 55 km/sec for every million parsecs the galaxy is away from us.

For example, if a galaxy had a velocity of 55,000 km/sec, it would be estimated to be 1,000 million parsecs away, or about 3.3 billion light years.

However, ongoing measurements have led to hotly disputed controversies about the value of H. It is thought to be anywhere between 40 to 80 km/sec/megapc. Ironically, there is less disagreement now and it generally thought to be back where it began, about 50km/mpc.

This is vitally important (to cosmologists, anyway) because it determines the age of the universe. The smaller the value of H, the older the universe and vice versa. Think about it. For a given speed of recession, and a given distance, the longer it took the galaxy to get out that far. Therefore, the older the universe.

Thus the current debate and frantic measurement projects. Just how big, and therefore how old, is the Universe?

However, this whole drive to determine a more accurate value of the Hubble Constant has taken a fantastic new twist over the past couple of years. Using Type Ia supernovae as a standard candle (this can be done because of the unique nature of Type Ia supernovae – another story) two competing teams of esteemed astronomers have discovered that it seems the Hubble Constant for the most remote (and therefore oldest) galaxies observable was less than it is now. ie The Universe is expanding faster now than then. It's accelerating. At first this finding was received with scorn, then cautious suspicion, now it is generally accepted.

Again, all this is built upon the Distance Pyramid. It seems that, as in all things in life, the more you know, the more there is to discover.

Bob Bee ■