MACARTHUR ASTRONOMICAL SOCIETY Inc.

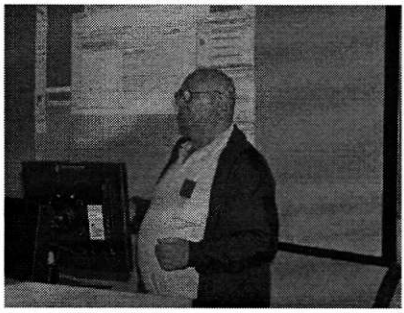
Journal

PRIME FOCUS

Volume 11 Issue 9 September 2006

President's Report

Greetings to all members and guests here tonight. Please accept my apologies for missing last month's meeting. As always I know that things are always in good hands with such a great committee on board and especially thanks to John Rombi for keeping the ball rolling.



Last month we had one of our own members Doug McEachern give us a talk on high dynamic range processing of astronomical images using Photoshop CS2. From what I heard the presentation was a great success and members who have a keen interest in imaging certainly got a lot out of the night. Well done.

Tonight we have as our special guest Paul Francis from the Australian National University in Canberra. Paul is currently the Australian Gemini project scientist. His research covers comets, quasars and high red shift galaxies. Paul's topic for tonight is "Listening to the Universe".

Paul wrote to us a while back and described his talk along the lines that astronomical data is mostly presented in a visual format. To quote Paul: "I've been experimenting with converting astronomical data into sounds. Sounds tell you less than pictures about sizes, shapes and positions of various objects in space, but vastly more about their spectra".

Paul will play us the sounds of a wide range of astronomical objects.

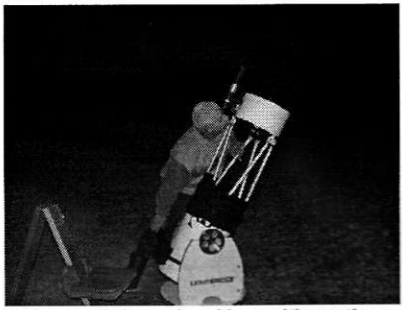
We thank Paul for taking the time to visit us, should be a fascinating evening.

Star Nights Galore!

Wow, we certainly have hit the ground running lately with some great public events, last month it was the science week viewing night at Macarthur Anglican High School which was a big success. John, Lloyd, Ian and Bob Monkcom together with Paul O'Neill went with telescopes in hand for a special viewing night at Mary Immaculate School at Eaglevale. It was a great night which went down a treat with over 60 school children eagerly looking at this great universe of ours.

Here are some shots of all the action:-

"So, do you come here often?"



"Slippery little sucker. I know it's up there somewhere."

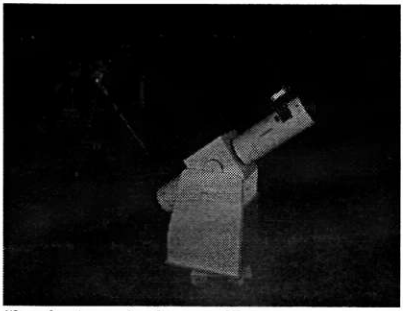
"Where's the rocket go in?"

"Let's see what the mailman left."

Amazing how all the kids kept out of camera frame. But at least here are our guys in action. Onya MAS!

We also had a bumper of a crowd for our own Macastro open night at The Oaks on 2nd September. We estimate that around 70 eager stargazers travelled out to Dudley Chesham Sports Ground, The Oaks for the night.
Here are some pics from that night.

"What, that little light up there is Jupiter?"

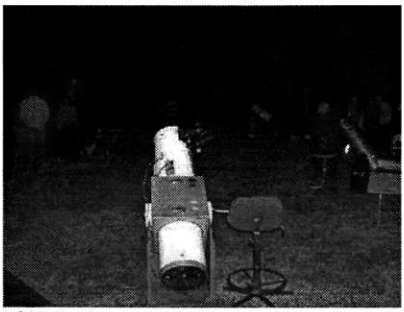


"Look at me, look at me!"

This was one of the most successful Macastro nights yet! Successful nights like these would not be possible without the fantastic support of many members, great work to all!

Even though it mostly clouded over, we were still able to show off Jupiter, Jewel Box and Alpha Centauri.

Welcome back Phil. And nice toy. Com'on, show us your laptop.



"OK, I'm boxy, but so is a Volvo and see how much they cost. And I go further."

The Dates

23/09/06 The Forest
14/10/06 Macastro Star night, Dudley Chesham Sports Ground
16/10/06 Monthly Meeting
21/10/06 The Forest
18/11/06 The Forest
20/11/06 Monthly Meeting
25/11/06 Stargard Field
08/12/06 Campbelltown Rotary Observatory

You may have noticed that we have relocated the 14th October Macastro public night to the

Dudley Chesham Sports Ground instead of Stargard field. We are still sorting out some OH&S issues, i.e. bridge crossing and toilets etc concerning Stargard only in relation to large scale public events.

Normal member nights at Stargard are not effected. Next one is 25th November unless advised in the next Prime Focus. Watch out for any Critical MAS emails as we may from time to time hold some off schedule nights.

Stargard Field.

As I mentioned in last month's journal some opportunities have come our way to further our goals around Stargard. I can now report that we have paid an administration fee as a co-user of the sports ground. The fee is a modest $55 per year. We have now been officially accepted as a group that has access to the facilities and we now hold all necessary keys in that regard.

This has come about as I was invited a couple of weeks back to address other users of the field at a meeting called by the management team of the sports ground. The meeting went very well with the possibility that other meetings will be held in the future.

I went into some detail last month about the "Stargard Field Telescope" and I thank SDM telescopes for making us such a great offer. John Rombi and myself now have an appointment coming up with Pat Farmer, sitting member for Macarthur. We are going to chance our arm at obtaining a grant for the telescope. Our plans are in place and we are very excited about progressing forward the society's long-term objectives.

However, I think it's very important to realize that it may be possible there will be no funding, so I am very aware that we should not build our hopes up. The time frame to secure the telescope is limited and if a cashed up buyer comes along in the mean time then it would completely acceptable for the manufacturer SDM telescopes to go with that.

We can only follow where the path leads. Certainly securing the Stargard Field for our use is a most valuable addition to our activities. We can always think about our longer term plans for a telescope down the track if our current initiatives do not bear fruit, but we will certainly try our best.

So that's about all for now, good stargazing until next time.

Kind Regards
Noel Sharpe President

Plucky Pluto Pipped at Post

You will have heard, no doubt, that that puny planet Pluto has been demoted from 'planet' to 'dwarf planet', and probably not before time too. Or is it? What do you think? Our society has been pretty quiet on the issue. Should we have a sharing of ideas, an open forum, at this month's meeting, or should we simply accept the International Union of Astronomers' decision? Remember, we will have to explain this some time to the public.

On the positive side, Pluto has had its two new moons christened: meet Nix and Hydra. What a mythologically dark foursome they make with Pluto and Charon. RB

Finding the Age of the Universe Part III

by Frank Kish

4) THE RECESSION OF GALAXIES, USING TYPE Ia SUPERNOVAE

a) The Measuring Method

The search for still higher and reliable luminous objects to confirm previous distance measurements, (as described above), led astronomers to the **Type Ia Supernovae** in the elliptical and spiral galaxies, whose luminosities indicated about the same peak absolute magnitude regardless of their environment.

Many astronomers view the Type Ia Supernovae as the best cosmic-candles for measuring distances from galaxies, and from where they can determine the age of the Universe; the reason is because these supernovae can be more accurately judged for their apparent brightness, than say, measurements made from the "Cosmic Expansion" method.

As a matter of interest, the observations of these objects highlighted first the concept of the expanding universe through the Hubble red shift, and the "dark matter" as the property of empty space.

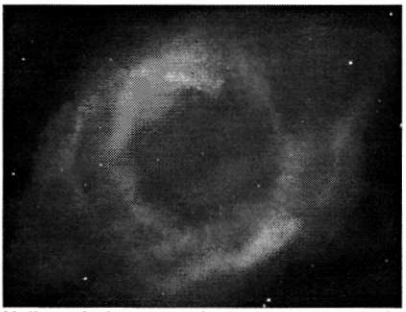
The *recession of galaxy* measurement is based on the application of the Hubble Constant, i.e.: the more recession a galaxy has, the more red shift it will indicate. Light from *supernovae* of distant galaxies is analysed through different wavelengths and compared with data received from already known galaxies; hence, the distance to any of these galaxies can easily be determined on statistical basis.

Such analysis of distant supernovae resulted in the average value of :

H_0 = 70 km/s.Mpc +/-10% , which made the host galaxies and **the age of the Universe 12 – 13.5 Gy.** approximately. (Prof. J. Mould. Mt. Stromlo Observatory. Canberra. June, 1999).

b) White Dwarfs, the End-stage of Solitary Stars

When a **low-mass solitary star**, (like our Sun), leaves the main-sequence (HR-Diagram), it becomes a gaseous red supergiant star of <4 M_{Solar}, then following its planetary nebula stage, it ends up as a stable **white dwarf**, with a size of <1.4M_{Solar}. Low-mass **solitary stars** do not produce supernovae.



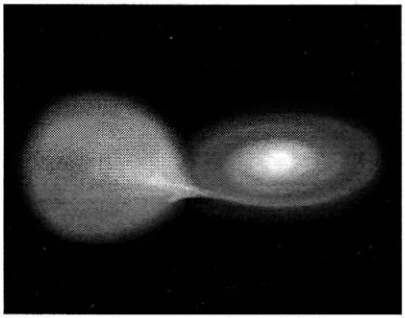
Helix nebula – a typical planetary nebula with white dwarf at centre.

Note by F.Shu: "White dwarfs resemble terrestrial metal in many respects. They shine because they have non-zero internal temperature, as relics from a more fiery past. They resemble glowing embers. It's degeneracy pressure and not thermal pressure, which holds it up against self-gravity; this is why it can come into true thermodynamic equilibrium with the cold

Universe. Their state will form a crystal lattice and solidify."

c) Type Ia Supernovae, the End-stage of Binary Stars

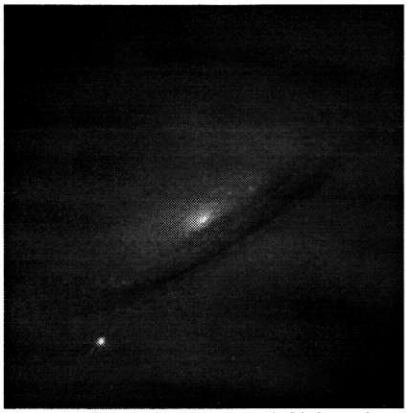
Initially, when a low-mass star is close-coupled with a **companion binary-star**, (which applies to most of the stars), that binary-star at its end-stage begins to transfer its mass and will raise the white dwarf's mass to $1.4M_{Solar}$, the Chandrasekhar limit.



White dwarf accretes material from red giant

At this point, the **white dwarf** is no longer stable against gravitational collapse, due to its radius decrease, its density-pressure and temperature increase; a **new fusion reaction** of carbon and oxygen into iron will begin in its core, and it will explode against the force of gravity and essentially the entire *star* is consumed in a gigantic thermonuclear reaction.

This phenomenon is called the **Type Ia Supernova,** which may be likened to the explosion of a hydrogen bomb, cca. the size of the Earth, but with the mass of the Sun.



Type 1a SN 1994d (bottom left) in galaxy NGC2546 in Virgo.

The reason why iron is such a common metal on Earth, (whose core is made up of iron), is that the main product of **Type Ia Supernovae** is iron, and they keep dumping it into the interstellar space at a rate of about $1M_{Solar}$ with every explosion.

d) The End-stage of Type Ia Supernovae

Although the mechanism is still not very clear, the white dwarfs of Type Ia Super Novae are "probably" blown apart and so do not leave solid core remnants.

Note by F. Shu: "The amount of energy released by such a supernova explosion is about 10^{44} Jules, being as much energy as the Sun radiates out during its entire 9Gy. lifetime."

Note by Kirshner: "If there are something like 10 billion galaxies in the observable universe, then since a century is: 3 billion seconds, a supernova per century per galaxy means there are about **three of Type Ia Supernova** occurrences at every second in

the Universe. The problem isn't a shortage of supernovae, it's that we can't look far enough in all directions."

5) THE SPECTRAL ANALYSIS OF STARS IN THE GLOBULAR CLUSTERS

Globular Clusters are a spherically symmetrical collection of the oldest stars in the Universe. These clusters may contain a million stars, and span some 150 ly. across. The mass of a star in a typical globular cluster is $0.7M_{Solar}$.

Knowing that the life cycle of a star depends on its mass, and also the brighter it is the shorter is its life, hence the suggestion is that the oldest globular clusters may be around for over 10Gy.

One of the uncertainties in determining the age of a globular cluster is the luminosity of its stars. However, from the most luminous stars on the main sequence astronomers can easily calculate the upper limit for the age of a cluster, where all the stars assumed to have the same age, hence the same luminosity.

Since all the stars, which are located on the "horizontal branch" on the HR.-D. have their same time-averaged luminosity, such as the star clusters, the Cepheids and the R.R. Lyrae, they are good distance indicators. As the age of RR Lyrae in a globular cluster is proportional to the reciprocal of their luminosity, thereby the distance to the globular clusters can be determined in a more accurate way.

The horizontal branch of these stars is located way above the location of the Blue Giants; therefore they are not shown on the attached HR-D.

From average distance measurements **the age of the Universe** is **14.6 +/- 1.7 Gy.** approx. (Chaboyer-1997) Others' data are between wide ranges.

6) THE AGE OF THE OLDEST WHITE DWARFS

As described above, the end-stage of a low-mass solitary star, a mass of $<4M_{Solar}$, is **white dwarf**, (similar to the fate of our Sun). The white dwarf is present already inside a red giant star, but it becomes visible only after the red giant has blown off its gaseous envelop. The hot stellar core of the white dwarf ionizes the gas that becomes the glowing planetary nebula.

In this case, astronomers look for the **faintest** white dwarfs to obtain the longest cooling period, which will also represent the **oldest** white dwarf.

Analysing the data obtained with the HST from the M4 Globular Cluster, this method yielded an **age for the Universe** of **12.8 +/- 1.1 Gy.** approx. (Hansen-2004).

CONCLUSION

Should we accept the different ages of the Universe, whose measurement methods are detailed above, an **approximate average age of the Universe** would result in the following objects and events:-

a) Cosmic Expansion: 15 Gy.
b) Type II Supernovae:12.5 +/- 3 Gy.
c) Type Ia Supernovae:13.5 Gy.
d) Globular Clusters: 14.6 +/- 1.7 Gy.
e) White Dwarfs: 12.8 +/- 1.1 Gy.

Total = 68.4 / 5 = **13.68 Gy.**
Approximate average Age.

It is truly impressive, and this has never been stated before, that using 5 different measurement methods of astrophysical entities and events should yield such a surprising result of 13.68 Gy. for the age of the Universe; for the reason being that this result is consistent with the most recent and officially acknowledge **13.7Gy. Age of the Universe,** obtained through the **Beryllium Analysis,** (ESO-Press Release). ■

[This ends Frank's excellent paper.
Thank you Frank.]

Some Casual Observations

It was Wednesday night, 13th September. I'd just come home from dinner at the Narellan Bela Pizza, well mellowed from sharing a bottle of Cab-Sav (but still below the limit).
I looked up and wouldn't you know it – a beautiful starry sky. Why don't we get these on a week-end?

On an impulse I grabbed my binoculars (does that surprise you?) and went out the back. Thankfully it was a moonless night and the seeing and darkness was beautiful. If I wasn't so mellow, I would have considered dragging my telescope out. If I had a Dob at home I would have, it was that beautiful a night.

My first target was Jupiter, nestling close to a fainter star. I'd already done my homework, having watched Jupiter drifting closer to this star over the past week. But on this night, the setting was almost poetic. The star, of course, was Zubenelgenubi, or Alpha Librae.

At mag 2.7 it was much fainter than Jupiter at mag –1.8 but they still made a distinctive pair separated by just 33' (about a Moon diameter). By the time of this month's MAS meeting, they will have widened to about 68'.

When I put my binoculars (12x50) on alpha Librae, it leaped out as a quaint double, the blue-white mag 2.7 and a white-yellow mag 5.2 only 3' away. While of 2.5 mag difference, the subtle colour difference of the two companions was obvious, even in my binoculars. Quite a nice binocular double (yes, it's in my book – I checked).

Then, as the night was so delightfully dark, even for a Mt Annan back yard, I went on a binocular tour of the visible sky. Even I was surprised how clear and bright ω Centauri was (just over the roof of my house). M22 and M8 (Lagoon Nebula) in Sagittarius were a treat. The old faithfuls of M6 and M7 at Scorpius' tail were clear and sharp, while I drooled over NGC6231 in the scorpion's curving spine.

M4 near Antares? A snap, as bright as I usually see it in a telescope. I was amazed. Even NGC6322 between ζ and θ Scorpii, a pretty open cluster of around 20 stars had its brighter stars resolvable – as good as I've ever seen it in binoculars. It has a roughly triangular shape and it kind of reminds me of the Jewel Box, but not as colourful.

Then I roamed at random, finally settling on Ara to the east of Scorpius. I knew what to look for and found it immediately – NGC6397, a 6th magnitude globular. While some books suggest you will see it as a 'fuzzy star', I saw it as a globular, a fainter version of Omega Centauri with a definite area of fuzziness, not 'star' like at all.

What a grand night for viewing it was – I just wish I could have bottled it. RB