MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal

PRIME FOCUS

Volume 5 Issue 7 August 2000

President's Report

I wish to extend a very warm welcome to all members and guests attending tonight's meeting and I'm particularly pleased to announce as our guest speaker tonight, Mr Zane Hammond.
Zane owns and runs the Magellan Observatory, which is near Goulburn. I'm sure that everyone will make Zane most welcome.

Acknowledgments:

Our field nights have just been fantastic and the new sites are working a treat, but the best part is the assistance given to members who are learning photography, aligning or finding that new object. I must thank Peter Druery and Peter Elston for sharing their expertise and skill at the recent Oakdale farm field night.

Whilst on the two Peters I wish to congratulate firstly Peter Elston and his wife Bobbie for attaining that highest of goals, logging **100 Messier Objects**, a milestone in Deep Sky observations and a very impressive feat to accomplish. **WELL DONE!**

Secondly, to Peter Druery for assisting on the Friday nights at the Observatory and for making himself available on a regular basis, again...
GOOD WORK!

Speakers & Gremlins:

That pesky little Red Planet Mars has done it again. Last month we were ready to roll with a presentation on Mars by Phillip Ainsworth, but a last minute change in Phil's work schedule sent our plans crashing down faster than the Mars Polar Lander. However, we recovered well and last month's meeting was lots of fun, highlights were the many discussions about the total Lunar eclipse, a video supplied by John Rombi on The Sun and home video footage of the eclipse taken by Stephen Hutchinson and plenty of photos.... mine!

There was a lively debate about Daniel Ross and his ongoing never ending telescope modifications. The best comment on the night was by Michael Fisher who in trying to grapple with Daniel's inventions, simply said "What exactly is it?" This rather dry perfectly timed comment drew much laughter, I can't wait to see Daniel's next project. **WELL DONE!**

This is a big issue of Prime Focus and I've waffled on enough, but some important events are coming up so I'll try to be brief.

Guest Speakers:

SEPTEMBER : Dr Frank Stootman, S.E.T.I Australia centre. We will visit the Space Science Lab and watch the live feed from the Parkes Radio Telescope and all the news from S.E.T.I.
OCTOBER : Fred Watson from the Anglo-Australian Telescope will be at our meeting. We saw Fred at the science week lectures about 15 months ago and he showed us what a great speaker he is.
NOVEMBER: Dr Don Neely will show us experiments in spectroscopy, which is the analysing of Starlight into its various components. There will also be a visit to a science lab.

Please note that for convenience sake we will still start our meetings as normal in this room (ROOM 5 BLDG 22) and then proceed down to the labs, and then back here to close and have a cup of coffee. There will be a little bit of walking, but it will be lots of fun.

Late Breaking News:

Australian scientist Dr Jack Davidson arrives Tuesday 22/8. Dr Davidson is N.A.S.A.'s chief scientist working on "SOFIA", the infra red flying telescope observatory. It is planned that a day time lecture will be held tomorrow 22/8 at this university and also an engagement at the Sutherland Astronomical Society's Green Point Observatory will be held on Wednesday night 24/8. At the time of writing I'm a bit scant on the finer details, but I should be able to confirm them at tonight's meeting.

Yet More News:

The Society has done or is planning the following events this month.
9/8. Koshigaya Japanese exchange students star party at Kentlyn.
8/8. Leumeah scout group open night.
23/8. Cawdor public school day time lectures.

With Gratitude:

On behalf of the Macarthur Astronomical Society I wish to publicly thank the very kind donations recently bestowed upon us: 1) over 60 Sky and Telescope magazines dating back to 1985. They were donated by Rev. Andrew Grane.
2) 7x50 binoculars or 2 Plossl eyepieces, donated by Terry Storey and York Optical.
3) Redshift C.D. ROM and user guide, donated by Roger Powell.

The binoculars/eye pieces and CD will be used as prizes for an upcoming Guessing Competition. See details in this issue.

In Conclusion:

As your appointed representative I wish to duly acknowledge the wonderful support this Society receives from all quarters both near and far, and also to the way our members work together both on and off the observing field. All these things combine to make our Society one of the best.

Regards Noel Sharpe ■

Secretary's Report

It's great to see memberships coming in and I believe we are now up to 50 members. I think you would have to agree Attila gave a good talk (in June) and I thank him for his expertise in Egyptian Astronomy. It's difficult to get up and speak in front of people and for a first effort I commend Attila and all those who give it a go. Any other interested people in the Society who wish to speak on their favourite topic in astronomy are most welcome to volunteer for a speakers role. We would welcome you with open arms, for I find it amazing all the talent in this Society and how we all help each other. If you wish to have a topic, even for 15 minutes, give it a go and let me or Noel know so we can slot you into the MAS schedule of speakers.

Librarian's Report

I am pleased to see the library up and running with many members borrowing books, soon I hope to have the magazines put onto my computer for borrowing.

Web Sites:

Any one interested in joining the Mars Society a privately funded organisation started by Robert Zubrin. The society is based in the United States and is $50 U.S. to join. They have already in their second year built an Arctic Research Station at Devon Island in Canada. In 2003 they will be launching a small probe via NASA/JPL to Mars, and hoping by 2007 to have the approval and backing of NASA/JPL for a Mars manned mission. The journey will be partially funded by the society, Discovery Channel and NASA. The Mars Direct Plan will be summarised and written down in the next Journal. Maybe I'll even do a talk on it.

The web site address for those interested is www.marssociety.org or for information the e-mail address is info@marssociety.org

Anyone also interested in getting the latest space news can also subscribe to (free) to Spaceviews which is run by the (NSS) National Space Society, their web address is as follows - spaceviews-approval@spaceviews.com

Another great site is The JPL site which I know a few members of the society are members of already. It is as follows - JPLNEWS@jpl.nasa.gov

Hope these sites are of interest and helpful to any member interested in the latest space news on a weekly and fortnightly basis.

Latest News:

WET MARS

Global Surveyor has high resolution pictures of an area of about 120 acres which strongly suggests currently flowing water on Mars. The amount is estimated at being enough to support a colony for 20 years. I have also heard that 3 Olympic 50m swimming pools would be filled.

The evidence can be seen in Alcoves, Channels and Aprons that feature no where near the equator but 30 degrees north and south. Scientists believed till now water would be seen first under permafrost at the equator. The water deposits which evaporate rapidly into the Martian atmosphere are located on alcoves (the sides of craters), the channels (which cut through the [illegible]erial along the sides) and Aprons which is the material deposited by the water at the bottom of the channels.

The ground water must be flowing and it's estimated the distance below the surface could be several hundred metres. The water percolates until it reaches the face of the crater where an ice barrier forms. Pressure in the ice barrier builds up and then when broken causes a sudden flooding out of the side of the crater, then Mars Global Surveyor detects and sees the result of the water on the crater wall.

The image shows light and dark features on the photograph taken by Global Surveyor and is within the past year or two years and is still occurring now.

These water geological features if proven totally true will change the whole of the Mars expedition times (I hope). A colony could now survive on Mars knowing it has all the water it needs for survival.

Usually where there is water there is life, at least that scenario is evident on Earth, even deep down in the Antarctic life thrives. If water is currently flowing on Mars today as suggested, then life has probably taken a hold also on the planet.

NASA's current plans are to send an orbiter in 2001 which will take infrared details of the surface.

Scientists as well as me believe that the only way to solve the mysteries of Mars water, Face, pyramids is simply to send a manned/women mission to Mars by 2007. It can be done today, with our technology. Let's do it and solve the riddles Mars poses for all of the human race.

Scientist Journal on June 30th published the details of the

water on Mars. I'm not sure if we get this publication in Australia, but if anyone happens to see it or purchase a copy, could they let me know please. My phone no. is at the top of Prime Focus.

The full version of this unedited article can be viewed via the Spaceviews web site as mentioned above, or information is also available from the JPL site or NASA.

Latest update from The Mars Network - Scientists now believe that Mars may have 3 times more water than originally felt it had from Mars Global Surveyor. In the past it is now being studied just how much water Mars actually had in the past and its current amount. Vast salty Oceans as on Earth are now believed to have once been on Mars, and with current water being just about proved it certainly gives a greater chance of life not having once been on Mars but could present today in bacteria and other life forms under the surface of Mars in the now possible running water. On Earth life takes a foothold anywhere, why not also on wet Mars ?

MIR

The cosmonauts left the MIR space station yet again after patching up and fixing the aging space station. MIRCORP is hoping to lease MIR for space tourism. Already 1 American businessman has pre-paid his flight (Dennis Tito) founder of a major jet propulsion science lab employee. The flight and stay is expected to happen early next year.

NASA's BUDGET APPROVED

NASA has for once not had to fight tooth and nail for its annual influx of funds from the Government.

THE INTERNATIONAL SPACE STATION

The ISS is looking forward to a visit finally by the Russians who are putting up their Zvezda spacecraft which is being currently planned for launch on July 10th-12. I believe this will give power to the ISS and some of its modules.

ASTEROIDS

A study by scientists have estimated that 900 potentially dangerous asteroids in orbits could in the near future cause major problems for The Earth and its 5 billion inhabitants. All these asteroids are 1 km or more in size and would cause substantial damage to the Earth and most probably wipe out all life. NASA currently is on the lookout and picks up 90% of all large near Earth objects.

FIELD NIGHT (THE OAKS)--JUNE 24th

I finally made it to the Oaks and was dazzled by the crystal clear sky which confronted me. This location (only 40 mins from my house) has inspired me back into observing and watch out all you Messier Hunters for Phil is joining in, and hopes Oakdale will be just as promising as last week at the Oaks. The trek out there is worthwhile, the weather is cold but if you rug up and take plenty of hot food and drink you will enjoy the evening. See you out there, you won't be disappointed.

BICENTENNIAL STAR NIGHT

The Bicentennial star night was a huge success, and many members in our society attended with their scopes.

The night started off well at 6pm with the public slowly filtering into the art gallery and perusing the wonderful photographs of David Malin. As the night was unfortunately cloudy the telescopes were in use indoors. MacDob has never viewed the Horse Head Nebular so clearly, nor Omega Centauri. The small finder scope on MacDob was a fascinating spectacle to all the young children who looked through the telescope. One child was particularly interested and their family is looking into joining the society. We set our scopes up in front of our favourite photograph, Peter even took a photograph of The Horse Head Nebula. I'll be keen to see how it turns out. All the children were exceptional in

there behaviour except one and I had to tell him that it wasn't a ride or a-horse. Fortunately I stopped the child before he climbed on top.

After the public had their hour looking over the beautiful photographs and learning about the different scopes in our Society, we were treated to a very enlightening slide presentation of David Malin's Astrophotography. I could see Peter and Noel salivating at what they only dream they could do with there scopes and cameras.

Just prior to David Malin's talk we were entreated to a short speech from our el presidente Noel who spoke with his usual wit about our Society and some of the fun we have on our viewing nights. Then Ragbir spoke briefly before we were mesmerised by David Malin's slide presentation.

After the talk, some of us had refreshments (Quiech not bad) for a small $2 donation. I was showing some of the children MacDob when one of the kids said "Where's Mole and his telescope", I replied "Mole?" and then suddenly realised they meant our undercover agent, come President The Mole (Noel Sharpe.)

These nights are fabulous for one simple reason. They show the very interested public and the children Astronomy and when children are hooked on something they sometimes and quite often if influenced in the right way become adult astronomers as with the case of most of our members in the society. I remember seeing Saturn at the Sydney Observatory and nagging, pleading and begging my parents to buy me a telescope. I was rewarded the next year and saw Saturn, Jupiter and have been hooked ever since. These nights show children the fun and amazing joy that can be found in astronomy and that childhood amazement stays with me and most other amateur astronomers, all through the efforts from a public open night.

I would like to thank all the members who attended the evening, Bob with his fountain of knowledge showing the public around the gallery and telling them about each photograph, Daniel and Ragbir for helping with the organisation of the night, and all the members who came lent a hand. I would especially like to thank all the members who brought scopes and Noel for his tremendous achievement in organising this wonderful night.

It would be remiss of me not to mention the leading contributor to the night, David Malin for his wonderful talk and slide presentation and the opportunity given to us (MAS) by Tristan at the Art Gallery to hold such a fantastic event. The night despite the weather being cloudy was a huge success and I know through this night many people have been touched by Astronomy and this may lead them to exploring it again or for the first time in their lives. Thank you again all you assisted in the night, it was a wonderfully successful night.
An article was also in the Advertiser (July 5th) which told how well the night went.

OAKDALE (1st July)

The night started out with a hearty meal at Hungry Jacks. After our small number of 6-7 made it to the site it clouded over almost immediately.

The weather started off dismally with light rain falling. Then cloud started to go and come, but by 11pm beautiful skies were above us. This prompted me to get MacDob back out of the car, and led me to viewing and recording my first 4 Messier objects. M7 near the stinger and the star Antares, M4 which is also near Antares, M8 The Lagoon Nebula and finally M57 The Ring Nebula which is located between two stars near Vega. After an hour of searching for other Messiers I finally gave up when huge black clouds and light rain started falling around 12 midnight.

A great night was had by one and all, especially me who finally recorded some Messier objects.

Phil Ainsworth ■

Manned Exploration of the Red Planet

John Casey 8/5/2000

I have been reading a very interesting book from the Campbelltown Library called "**The Case for Mars**" by Robert Zubrin. [See 523.43/Zub]. I encourage you to read it to see the complete history of man's exploration of Mars from telescope to unmanned touchdown and automated surface photographs and small scale robotic exploration done so far and his plans for future missions. The book in detail even covers the search for life, manned exploration, building bases, power supplies, colonisation, and terraforming of Mars. But above all, Robert Zubrin's book is presenting the case for manned exploration of Mars, and in particular, his detailed plans for a Mars Direct mission.

History of Development of the "Mars Direct" Mission

On July 20, 1989, President George Bush, trying to emulate President Kennedy's famous speech committing the USA to landing on the Moon, committed the USA to a sustained program of space exploration of the solar system and even the permanent settlement of space. He spoke of the need of more than a ten year plan, and announced, for the coming decade [for the 1990's]- establishment of Space Station Freedom. Next, for the new century, a plan to return to the Moon, and then, a journey into tomorrow, a manned mission to Mars.

In response to this speech, NASA set up a team representing all the centres of the agency and supported by all the major aerospace contractors, to come up with plans to meet these objectives. The team returned after three months with a document entitled "Report of the 90 Day Study on Human Exploration of the Moon and Mars". This document concluded that the nation would need a space infrastructure buildup of **thirty years** to go to Mars.

NASA would build the previously envisioned Space Station, but would now triple its size with the addition of "dual keels", to contain large hangers in which to construct interplanetary spaceships. There would also have to be assembled orbiting facilities such as free flying orbital cryogenic propellant depots, checkout docks, construction crew facilities, etc. The Mars spaceships would be huge- weighing >1000 tonne, and need development of new propulsion systems. Mars missions would require 18 months in transit for a round trip, with a one month stay in Mars orbit. A smaller craft would descend to the surface, allowing a small crew to explore the surface for about 2 weeks.

The cost estimate of this proposal was staggering - **$450,000,000,000!** Congress was not impressed, and cut off all funding of the Space Exploration Initiative [SEI]. The greed and self interest of contractors and existing NASA pressure groups had cast as critical technologies every existing, planned and wished for development program they could list, and came up with the most complex mission architecture possible. The initiative was as good as dead unless the project was severely cut back to size.

A selected management meeting of Martin Marietta Astronautics, a prime NASA contractor, took place in January 1990 at Colorado Springs to discuss the situation. Robert Zubrin and Dr Ben Clark were invited as "ideas people", and at the meeting they suggested a small team develop their own "blue sky " approach to Mars exploration, completely free of all NASA's current prejudices. Thus in February, 1990, Martin Marietta formed a 12 person "Scenario Development Team" to develop broad new strategies for human space exploration.

Robert Zubrin lead this team of engineers and researchers at Martin Marietta Astronautics, based in Denver, Colorado to develop a plan for a series of Mars missions based on the idea of "Living off the Land", under a project named "Mars Direct".

The intent was to develop the quickest, safest, most practical and least expensive way to undertake the exploration and settlement of Mars. This project was focused on putting forward a realistic and affordable option for manned exploration of Mars only - with revisits to the Moon only a side issue.

They wanted all resources designed, optimised and committed to this objective, and above all, a small and fast approach. They believed that the project must be completed within 10 years or suffer the same loss of direction and support that happened to the Apollo program. Their approach was very different to the response of NASA [which clearly not meeting any of these objectives], and was a commercial gamble for the company as far as telling the customer [NASA} that they were wrong.

Early thoughts were truly revolutionary, with a nuclear engine to provide high efficiency thrust but, with the American public generally against nuclear power, this was shelved and another equally innovative approach was taken to allow for the necessarily smaller delivery payload of conventional rockets. To keep the costs down, and to complete it in 10 years, they would plan a Mars manned mission using only heavy lift booster rocket components already developed, and carry only sufficient fuel to get safely onto the Mars surface [within the constraints, it would not be possible to carry all the fuel and supplies for the forward and return flights without bigger spacecraft]. In order to do this at all, and still allow return, the payloads were to be spread over two space vehicles, - one manned, the other fully automated, and containing a chemical plant capable of making rocket fuel for the return journey. This would be manufactured whilst on the Mars surface, utilising the Mars CO_2 atmosphere as a reagent . This unmanned spacecraft would be launched using a variant of the Space Shuttle system - but the Space Shuttle craft would be substituted by fuel tanks and rocket motor to enable heavier payloads to be lifted.

Earth Lift Off Hardware

David Baker, one of the team, was a spacecraft systems engineer, who had, in 1989 designed a variant of the Shuttle vehicle called Shuttle C, which replaced the orbiter with an expendable cargo pod. By fitting a hydrogen/oxygen upper stage this became Shuttle Z, a heavy lift vehicle which could place 130 tonne into low earth orbit [compared with 70 tonne for Shuttle C]. This was just 10 tonne less than what was achieved by the Saturn V booster in launching men to the Moon, but with much cheaper and newer technology. A further redesign of the launch vehicle by Baker optimised it for a direct lift of the payload into interplanetary space, but still using the same basic hardware units for the spacecraft which would then be called "Ares". In order to overcome the reduced thrust of conventionally fueled rockets, the supplies needed at Mars would be sent by two separate missions. By dividing the load between two missions, all the required mass could be delivered to the surface of Mars, with sufficient aerobraking into the Mars atmosphere to remove the need to carry extra fuel for retrorockets to slow the approach to Mars.

By landing directly on the Martian surface instead of going into orbit around the planet, the whole period in the vicinity of Mars would be useful for the primary mission of science and exploration. Martian rover vehicles would be part of the payload and these would use freshly made methane/oxygen fuel for their internal combustion engines. The rovers would allow long range exploration and deliver much more science for the dollars spent, as well as increasing the safety factors in using back up systems if there were problems. [It is easier to walk or drive (in an EVA suit) to a nearby backup ERV than to transfer to another whilst both vehicles are in orbit.]

But there was a problem- how do you transfer the fuel you made on the automated Mars lander to the second one containing the crew when it landed? It would be too risky

to hope to land side by side, or use Mars mobile robotic fuel tankers. The answer was to carry the return craft on the first vehicle. This way, even before the crew would leave Earth, they would know that they had a fully fueled Earth Return Vehicle [ERV] on the Mars surface, with it having survived the trauma of landing. By also launching a second ERV to travel in convoy with the manned flight, a further level of redundancy was built in. This second ERV would land within a rover vehicle range of the first landing site to prepare fuel for a following crewed flight, but be available, after fuel preparation, if the first crew required it.

Mars Rocket Fuel

But how do you make rocket fuel from the Mars atmosphere containing 97% CO_2? By old fashioned chemistry and good design and carrying some liquid hydrogen with you from Earth. The ERV payload would deliver 6.3 tonne of liquid hydrogen to the surface, where it would be converted into 94 tonne of methane/ oxygen propellant, and 9 tonne of water. Of this 94 tonne of propellant, 82 tonne would be needed to return the crew to Earth, leaving 12 tonne available to fuel ground vehicles using internal combustion engines.

The secret to making rocket fuel on Mars is to bring with you liquid hydrogen in heavily insulated tanks. These, without any refrigeration reduce the boil off rate of liquid hydrogen to less than 1% per month. Gelling the hydrogen by a small amount of added methane reduces the boil off rate further, by as much as 40%. Refrigeration systems would weigh too much. The Mars atmosphere at the two Viking ground sites varied between 7 and 10 millibar. Allowing exposure of activated carbon or zeolite to the Mars atmosphere at night [at -90C], then desorbing it during the day [at +10C] would give a source of CO_2 at > 1 atmosphere [Earth] pressure. The CO_2 is then reacted with hydrogen to produce methane and water by the Sabatier Reaction $CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$. This is an exothermic reaction [needs no energy input to drive it and delivers excess heat], and using a nickel or ruthenium catalyst, the reaction is driven to >99% completion.

The water produced is condensed out and then electolysed to generate hydrogen and oxygen $2H_2O \rightarrow 2H_2 + O_2$. Other chemical treatments are mentioned that can optimise the ratio of methane to oxygen to get the best possible rocket thrust efficiency. A prototype automated rocket fuel manufacturing plant was built with a small grant [$47,000] from NASA's Johnson Space Centre in 1993. On January 6, 1994 the small scale integrated plant, operating on simulated Mars atmosphere, began producing 400 kg of the methane/ oxygen propellant, stored separately and cryogenically, at a 94% conversion efficiency. It operated for 10 days without operator intervention, thus proving the concept was sound and robust. This pilot unit had a Sabatier reactor of ruthenium catalyst within a metal pipe only 36cm long and 5cm diameter. The Electrolyser was 25cm long, and weighed only 3kg. The total mass of the working unit was only 20kg, and it used < 300 watts to produce the 400kg of propellant.

Getting There

When Mars is at its closest to Earth, at "opposition" it is 56 million kms away. At its furthest, at conjunction, it is 400 million kms away. To be economical on rocket fuel, the best time to launch is when Mars is in conjunction, when it is furthest away. This was first calculated back in 1925 by the German mathematician W. Hohmann, and is so because with this path you can travel along an ellipse which is tangent to the Earth's orbit at one end, and tangent to Mars at the other end. The more you deviate from this path, the more fuel will be needed. The path required is 400 million kms long - 1000x further than going to the Moon. However, because the spacecraft can utilise Earth's 30 km/sec velocity in orbiting

the Sun, it can achieve 33km/sec, or 20 X the Apollo Moon mission velocity. This slows as the spacecraft approaches Mars, but Mars is going in the same direction at 24 km/sec so that the spacecraft , still moving at 21 km/sec at that stage, will only have to wash off an approach velocity of 3 km/sec by hitting the Mars atmosphere.

Such a "Hohmann transfer" would take a journey of 258 days, but spending a little fuel can speed this to 180 days. For certain Earth departure velocities, and the spending of some fuel, it is possible to go to Mars on a trajectory that will bring you back to Earth if you decide not to go ahead with orbit capture manoeuvres at Mars. Apollo 13 used such a **free return** trajectory to Earth after they aborted their Moon mission. There are only a limited number of such options for a Mars mission, as shown in the table 4.2 of the book.

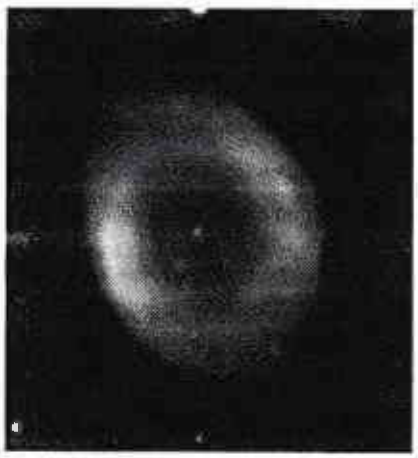
Free Return Trajectories between Earth and Mars

	Earth Departure Velocity	Orbit Period	Time to Earth Return	Transit to Mars	Mars Aeroentry
A	3.34 km/s	1.5 years	3 years	250 days	Easy
B	5.08 km/s	2.0 years	2 years	180 days	Acceptable
C	6.93 km/s	3.0 years	3 years	140 days	Dangerous
D	7.93 km/s	4.0 years	4 years	130 days	Impossible

Note that higher speeds makes the spacecraft swing out in a wider orbit around Mars, and actually takes longer to return to Earth if the Earth return mode is used, compared with route B.

Well, with the Mars Direct mission a possibility, what would you take with you? Robert Zubrin went into a lot of detail in working out such a payload, as will be seen in the next installment of this article.

The Ring Nebula (in Lyra)



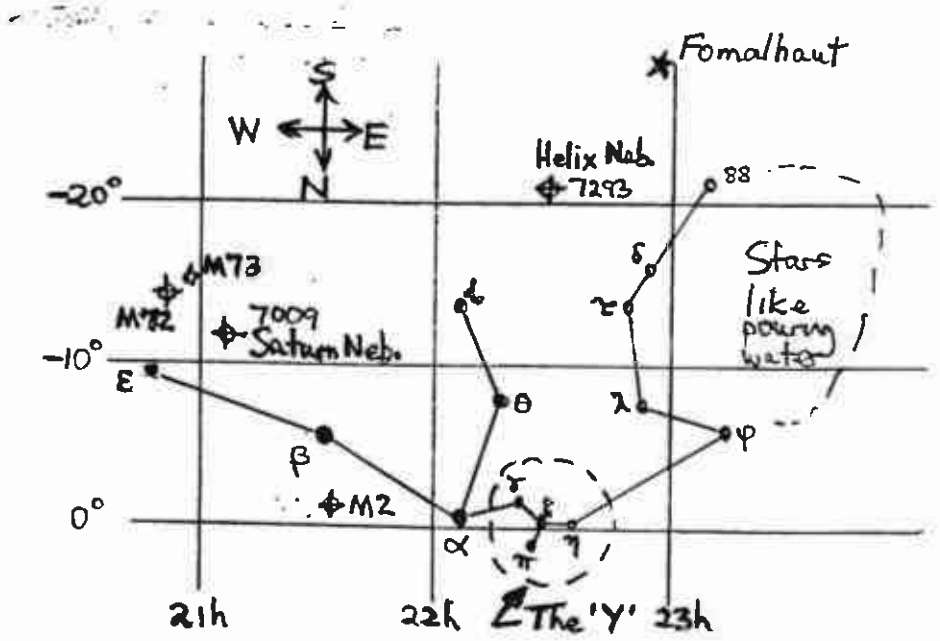
This is a fabulous example of the planetary nebula. It may not be the largest in area in the sky, but it is a delight to pick out in a small (or larger) telescope. Unfortunately, at 9th mag. it is too faint for normal 50mm binoculars.

Where to find it? If you look north and find Vega (at mag. 0.03, it's the 5th brightest star in the sky), you will see a long parallelogram above and to Vega's right. Almost exactly mid-way between the top two stars of the p'gram is M57.

Variously described as looking like a doughnut or a smoke ring, it is 2,000 l.y. away. Larger and larger apertures give you better views of the ring which is supposed to take on its blue-green appearance for anything at or over 200mm. (Go for it, you light buckets.)

The term 'planetary nebula' of course has nothing to do with a planet, except that it appeared to early astronomers to be similar to Uranus and Neptune. ■

Aquarius - The Water carrier



As one of the oldest constellations and as the focus for 'The Age of Aquarius' of 'Hair' and astrology fame, this constellation has urned our respect (Sorry about that! – Ed.).

It's not easy to locate, despite its size, about 45°x20° , as it has only three 3rd mag stars, with the rest fainter. However, it does contain some interesting stars, three Messier objects and two particularly interesting nebulae.

How to find it? Use a Star Wheel of course! But, as a general rule, for this time of the year (at 9pm):
- Find Scorpius (low in the West).
- Follow Scorpius through Sagittarius (Tea Pot).
- At the end of Sagittarius, move up (North) about 10°. Then for the next 45° to the East in that line, until level with the bright star Fomalhaut, is the constellation Aquarius. It is generally in the North half of the sky.

I told you it wasn't easy. It's much easier with a Star Wheel.

Different references connect the stars in different patterns. However you do it, it doesn't look like a guy carrying an urn (hence the awful pun) to me – especially upside down. (It's sometimes called the 'Water Pourer', explaining some of the star names).

For what it's worth, the urn/jar/bucket is represented by the stars Gamma (γ), Zeta (ξ), Eta (η) and Pi (π). In fact, this jar is usually the easiest to find because of its distinctive 'Y' shape. You can star hop to the rest of Aquarius from there.

(Again, the references disagree significantly on the distances to these stars and objects. For the purposes of this article, I have used the distances noted in 'Collins Pocket Guide to Stars and Planets' 2nd Edition).

Here are some of its interesting features:

α (Alpha) Aquarii (22h 6m, 0.5°) represents the Water Carrier's right shoulder and is called 'Sadalmelik'. Mag 2.9, it's a yellow supergiant, about 550 l.y. away. Its diameter is 80 times the Sun's and luminosity about 6,000 times the Sun's.

β (Beta) Aquarii (21h 29m, - 5.8°) is Sadalsuud, also a yellow supergiant, about 680 l.y. away, mag 2.9, with a luminosity about 5,800 times that of the Sun.

γ (Gamma) Aquarii (22h 22m, -1°) is called Sadachbia and is a 3.8 mag white star 180 l.y. away. γ forms the most southern of the two western tips of the 'Y'. It is also supposed to mark the Water carrier's right elbow. (So the line between α and γ is his humerus bone?). On a historical note, in 1643, the Capuchi friar De Rheita of Cologne, thought he'd discovered five new Jupiter moons when that planet entered Gamma's field. However, they turned out to be several faint stars just south of the jar. Can you spot them?

δ (Delta) Aquarii (22h 55m, -16 °) is called Skat, 'The Shin Bone' which it depicts. Mag. 3.3, Skat is a Sirius type white main sequence star 68 l.y. away. A naked eye companion directly south is not gravitationally related.

ε (Epsilon) Aquarii (20h 48m, -9.45°) is Albali, a mag 3.8 Sirius type white main sequence star about 110 l.y. away. It supposedly marks the towel held in the Water Carrier's hand.

ξ (Zeta) Aquarii (22h 29m, 0°) is at the centre of the 'Y', mag 3.7. This star is a good test of your telescope's resolution. ξ is a binary, about 98 l.y. away, with twin white stars, mag 4.4 and 4.6 separated by 1.7 sec of arc (about 100 astronomical units). A 75mm aperture with high magnification should resolve them. Though not visible, there is a red dwarf companion to the second white star, orbiting at the amazingly small distance of 9 AU (about the distance from our Sun to Saturn).

λ (Lambda) Aquarii (22h 50m, -7°) mag 3.8 lies at the head of a stream of stars that appear to be streaming from the water jar into the mouth of a fish.

Messier Objects:

M2 (NGC7089) (21h 34m, -1°) is a bright globular cluster, suitable for binoculars and small telescopes. Medium telescopes show its compressed centre with outlying stars like rays, while larger scopes (200mm) will resolve its individual stars. M2 is about 37,000 l.y. away.

The majority of stars in M2 are red and yellow giants with absolute magnitudes of –3. If you put the Sun at such a distance, it would appear as a faint 20.0 mag star (visible only in the most powerful telescopes). This makes you realise that M2's stars are pretty bright.

(M2 – NGC 7089)

M72 (NGC6981) (20h 54m, -13°) is 56,000 l.y. away and at mag 9.0 is a poor visual cousin to M2. It is considered a difficult cluster to resolve into individual stars, which may seem surprising as it does not have a high central condensation.

(M72 – NGC 6891)

M73 (NGC6994) (20h 58m, -12.5°).When you look at a picture of M73, you tend to check the caption beneath to make sure you weren't mistaken. "This is a Messier object?" you ask yourself.

(M73 – A Messier Object?)

Certainly not an object to highlight on an Open Night. I've seen more stars in a budget movie. Just enough for bridge but not a cluster.

It comprises four stars of mags 10.5 to 12.0 in a Y shape. To quote Admiral Smyth: "A trio (sic) of 10th magnitude stars in a poor field

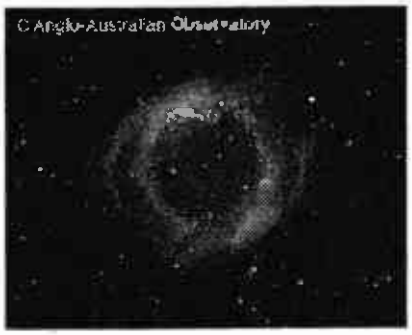
– that is M73. I give it out of respect to Messier's memory."

Planetary Nebulae:

NGC7009 (21h 4m, -11°) is called the **Saturn Nebula**. It is 3,000 l.y. away. Larger telescopes show rays curving around both sides of the main nebula disc, resembling the ringed planet, Saturn. Smaller telescopes show what appears to be a bluey-green 'planet'. The 8th mag. nebula has an intensely hot (55,000° K) central 11th mag. star.

(NGC7009 – Saturn Nebula)

NGC7293 (22h 30m, -21°) – the famous **Helix Nebula.** This is thought to be the closest of the planetary nebulae, about 300 l.y. away. Its dimensions are about a ¼ ° of the sky - half the apparent size of the moon. It is easily shown in binoculars (particularly those with 10x or more) and small telescopes on low power, which show it as a misty circular patch.
At its centre is a 13th mag star (a white dwarf) from which lines of radiation can be seen in the nebula, indicating the envelope's expansion from the star's initial mass shedding. This is the final stage of star evolution. Our Sun, a main sequence G2 star, will end up like this – in 5 billion years.



(The Helix Nebula Photo by D Malin – AAT Used with permission)

Galaxies:

Burnham lists 18 galaxies ranging from mag 11.9 to 13.2. The 3 faintest are:
NGC7606 (Sb spiral),
mag 11.9, 23h 16.5m, -8° 46'
NGC7184 (Sb spiral),
mag 12.0, 21h 59.9m, -21° 4'
NGC7727 (Sa spiral),
mag 12.0, 23h 37.3m, -12° 34'

■

Borrowing MacDob

The Society's own telescope, a 6" Dobsonian, is available for loan to members. It is easy to transport, set up and use. If you would like to borrow MacDob for a month, speak to Phil Ainsworth who is its custodian. Though there is no hiring fee, members are invited to make a donation of their choice which will go towards the upkeep and upgrade of MacDob

SECTION LEADERS

The following are the coordinators of these special interests in particular fields

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ASTROPHOTOGRAPHY:
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ADVANCED: Peter Druery

PLANET ADVICE:
Phil Ainsworth

Official Field Nights

(Key: **Farm** = Oakdale Farm
Air = The Old Airfield)
26/8 – Farm; 2/9 – Air
23/9 –Air; 30/9 - Farm
21/10 –Air; 28/10 - Farm
18/11 – Air; 25/11 - Farm
16/12 – Air; 23/12 - Farm
30/12 – Air.

Where the author of a Prime Focus article is not indicated, the author is the Editor.

Rombi On Our Tail – We made 100 Messiers

Well, Bobbie and I finally made our 100 Messier objects. It has only taken 6 years and we had to go to Thailand to get the last three. We have been stuck on 97 for quite sometime and everytime we have gone up to Ilford for three others it would always be cloudy. We spent six days in Bangkok and no way will you even see a star where we were as the pollution and lights were literally blocking out even bright stars.

Our week at a resort on Phuket Island was great, no pollution and one night the sky was kind to us as it is the monsoon season and all there was were sucker holes most nights. Every night we went out side about midnight checking the sky, and the night we were in luck we were able to see M39 (a very large open cluster in Cygnus), M52 (a large round open cluster in Cassiopeia) and M103 which is a pretty large round open star cluster in Cassiopeia and was quite a bright cluster. We used Don Whiteman's high powered binoculars which I was a little nervous taking away but Don insisted that we took them.

Once we found the first two objects we had to wait about 30-45 minutes for the last object we wanted to see. That was a little worrying as cloud was starting to move across our part of the horizon but once our object was up, the cloud had drifted across the night sky. We were both really chuffed and took it in turns finding each object. We took 'Stars and Planets' and our Wil Tirion Sky Atlas 2000 which enabled us to look at part of the sky that we had never really studied before.

Actually we had to get to our 100 as John Rombi is hot on our tail. (Sorry John)

Anyway, we have some exciting ideas for a MAS 100 badge which we want to design and encourage our members and in the future other members of other societies to aim for a MAS Messier 100 badge.

Congratulations again to John Rombi for making his 60 objects certificate and Ian Cook for his 30 Messier certificate, Bobbie and I are really pleased with how members have taken to the Messier search. (We heard on the grapevine that an unsavoury character has made 30 objects and 250 packets on the SETI search, this will have to be investigated further!!)

Pete and Bobbie Elston. ■

Spaced Out

Well, here's another month gone. Boy, the year's flying by now.

A few weeks ago I heard on the grapevine that U.S. scientists have been able to create and observe a particle that could travel **THREE TIMES FASTER THAN LIGHT**. I hope to gain more information about this in the near future.

A lot has been said about the eclipse last month, I'll also add my 2 cents worth. Watching the eclipse through the telescope was awesome. When the eclipse was at totality the Moon was bathed in a deep coppery colour. Using low mag the entire Moon was in the eyepiece with a generous star field around it. It made me feel like I was in orbit around Mars.
The best feeling of the night was when my wife Jenny and two children Kristina and Michael looked through the scope, the oooh's and ahhh's especially from a four year old was very gratifying.

To all the Messier hunters (and prospective hunters) there are two times of the year when the maximum number of Messiers are available to be seen in one night. The Northern hemisphere's is in March and for us "Down Under" it's in August. I hope that over the next year, the Messier hunters are able to hone their skills enough so that we can have a **MARATHON NIGHT, AT OR AROUND NEW MOON NEXT AUGUST** and yes, that means observing from **DUSK TO DAWN.** Maybe we could finish up with a **BREAKFAST BBQ**. If you're interested please speak to me at any of our meetings

or observing nights, or use the dog and bone and call me at 02 46267911.
P.S: The nuber of Messiers will be between **95-100** depending on the site we use.

John Rombi ■

Astronomy in the Gulf of Carpentaria 22.6.00

I am on a trip to the Gulf of Carpentaria with my husband and friends. We are enjoying our holiday and the weather is very nice. Here are things that we do not have in NSW.
The beautiful sunset, the crocodiles, and in the night sky the constellation, Ursa Major -the Big Dipper.

On the third of June we were camping just outside of Cloncurry and I observed stars in the northern sky that are not visible from NSW. I recognised the Big Dipper, which I knew already as a child in Germany. Now we are in Karumba in a caravan park and I am observing the Big Dipper with my binoculars. With binoculars I can see that Mizar and 80 Alcor are two stars.

24.6.00
In the caravan there is too much light pollution, so I took my telescope out of the park to a dark site, and pointed my telescope to the Big Dipper and found a 4th mag star between Mizar and 80 Alcor but a bit closer to Mizar. Each of these stars is also a spectroscopic binary, but is too difficult for me to find all these stars.

In the afternoon, I went on a boat cruise on the Norman River and Gulf. The sunset over the Gulf was beautiful. When the sun goes down it is getting flat, then the sun is becoming a fiery dash and is really not there any more, it is only reflecting on water.

28.6.00
We drove from Karumba to a quiet place on the Norman river near Normanton, where I had a beautiful clear sky and I found more Messier objects. Scorpius and Sagittarius with all the clusters are wonderful. About 10.30pm, the constellation Aquila is in the East, I have never seen it before.

29.6.00
I woke up at 6.30am and I saw the Moon, Saturn and Jupiter ½ hour before sunrise.

30.6.00
I woke up at 5.00am and saw Jupiter, Saturn and the Pleiades. I got my binoculars out because I was curious about the bright object to the left of Jupiter and Saturn and I found out that it was the Pleiades, Beautiful!

July 2000
We are on the way back home and I observed the sky every night. I watched the star clusters in Eta Carina and other constellations.

7.7.00
I woke up about 4.30am and again I saw Jupiter and Saturn, the Pleiades and Orion 2 hours before sunrise, it is all beautiful to see.

11.7.00
We are back in NSW now and spent one night in Bourke and two nights in Parkes. We visited Parkes Radio Telescope, I saw a film about astronomy and the telescope, and in the display room I bought a "Passport to the Stars " (valid for the Universe). In this passport are all the ten big observatories in NSW and their opening times.

12.7.00
Today we went all the way from Parkes, back home to Sydney. It was a good experience to see the outback of Australia too.

Ursula Braatz ■

THE ASTRONOMICAL RAFFLE

Ticket sales start tonight and continue at meetings and Star Nights, until drawn at the November meeting. Be in it to win these fabulous donated prizes:

1ST PRIZE: Choice of 7x50 Binoculars or 2 PLOSSL eye pieces.

2ND PRIZE: REDSHIFT CD ROM and Booklet.

3RD PRIZE: Bottle of Wine.

What's To See This Month

21 August – 17th September

The Planets:

Mercury only becomes viewable in early September where it appears in the evening twilight, gradually setting later as the month progresses. It will be much more viewable in late Sept-October.

Venus is the only realistically evening viewable planet this month (except for Uranus & Neptune – see later.) It sets about 7pm on 21st August and continues setting later (7.50pm on 17th September.) It will be fairly bright at mag. –3.9 and will be a virtual 'full Venus'. There is a nice encounter (but not a 'close' encounter) with the Moon which is a very thin crescent on 31st August. They will be 4.9° apart.

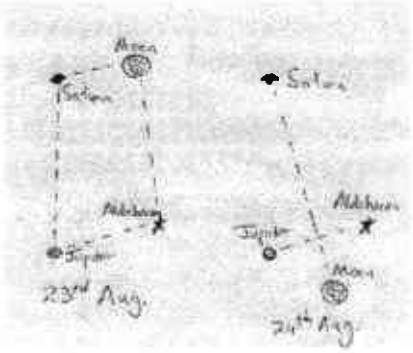
Mars is still close to the Sun in morning twilight and will remain a morning object for the rest of this year. For the early risers (about 5am), on 16th – 18th September, Mars will be only 1° from Regulus in Leo. Something to check out while having your OJ and Corn Flakes.

Jupiter & Saturn: They are still eminently visible – if you want to get up after 2am (22nd August) or 11pm (17th September.) They are still hanging about together approx. 10° apart with Saturn leading Jupiter. Jupiter is at mag. –2.3 while Saturn is mag. 0.2.

They both spend this month in Taurus in the vicinity of the red giant Aldabaran. If you've been keen enough to get up this early (or stay up this late), you should see some nice arrangements of the two planets with the Moon (in varying phases) and Aldabaran. Some examples are:

23rd August – the Moon and Saturn (only 2° apart) form the short end and Jupiter and Aldabaran the long end of a **trapezium.**

24th August – the roles switch and the four form more of a cross, with the Moon and Saturn at opposite long ends, and Jupiter and Aldabaran at opposite short ends. The Moon will be 5° from Jupiter.



Uranus & **Neptune** are still visible all evening about 15° apart.

Uranus, at 5.7 mag. is a borderline naked eye object (depends on your eye sight and the sky) but definitely a blue-green binocular object. From 21 Aug – 17 Sep, it is moving from RA 21h 24m, -16° to 21h 20m, -16° 20' in Capricornus.

Neptune, at mag 7.8 is a borderline binocular object, assuming you know where to look (between 20h 26m, -18° 15' to 20h 25m, -19° 3') but easily spotted in small to larger telescopes. It too is in Capricornus, very close to the star π Cap., a mag 5.3 blue-white giant which has an 8.9 mag. companion. [20h 27m, -18°]

Constellations:

For those of us without a fork mount Alt-Azimuth telescope (sorry Ragbir), it's a great time for viewing Scorpius and Sagittarius which are virtually directly overhead.

In fact, this is a good time to view the following constellations which can be 'easily' found using your star wheel:

Crux, Centaurus, Libra, Ara, Scorpius, Ophiuchus, Hercules, Corona Australis, Sagittarius, Scutum, Aquila, Capricornus, Delphinus, Cygnus, Tucana & Aquarius.

If you can fit all the interesting objects from that lot in one star night, you are doing well.

What are some of the features of the above constellations?

Libra: NGC5897 is a loosely scattered globular cluster 40,000 l.y. away. 9th mag, but needs a reasonably large aperture to appreciate.

Ara: NGC6397 is a glob, only 7,200 l.y. away. At 6th mag. it can be sighted through binoculars and looks good in small scopes.

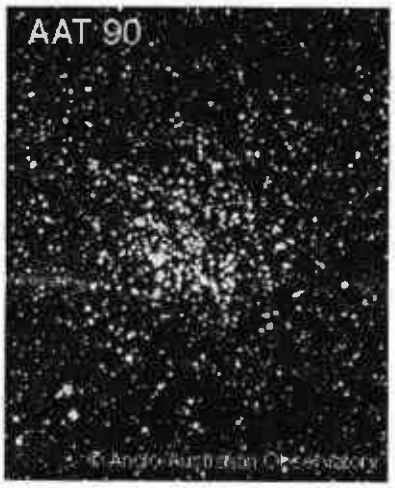
Ophiuchus: Where does one begin? ρ Oph. is an interesting multiple star visible in small scopes. It comprises three binocular stars at mags 5.0, 6.7 & 7.3. But the mag. 5 star is a binary with a 5.9 mag. companion. High magnification in a telescope should split these two.[16h 26m, -23°]

Then M10 (7th mag glob), M12 (7th mag glob), NGC6572 (9th mag. planetary nebula.)

Hercules: M13 (a 6th mag. glob.)

Corona Australis: NGC6541 (a 7th mag. glob) visible in binoculars.

Scutum: M11, the Wild Duck Cluster, a beautiful arrangement of about 200 stars. [18h 51m, -6°]



M11 (Photo by D Malin)

Aquila: 15 Aquila is an interesting double star. You look at it and decide if the 5.4 mag. yellow star's partner (mag. 7.2) is purple or not. I reckon it is, so there. [19h 5m, -4°]

Capricornus: α Cap. is an interesting multiple. Its optical

binocular pair of mags. 3.6 and 4.2 are each true binaries that can be split by small apertures. In fact, the 4.2 mag. star's mag. 11 companion is in fact itself a binary comprising two mag. 11 stars which can be split by 100mm+ apertures. Fascinating.

M30, a 7th mag. globular 27,000 l.y. away. See if your medium aperture telescope can resolve it into stars.

Delphinus: γ Delph. Is a lovely double with gold (mag. 4.3) and yellow (mag. 5.1) components. [20h 47m, +16°]

Cygnus: β Cygnus (Albireo) is a corker of a double (keep this one up your sleeve at Open Nights). Its yellow and blue stars look like distant party lights.

Tucana: 47 Tucanae is the 2nd most glorious globular in the whole sky;
Small Magellanic Cloud (SMC);
NGC367 is a small 7th mag. globular 29,000 l.y.away.

Aquarius: M2 is a 6th mag. globular, visible in binoculars.

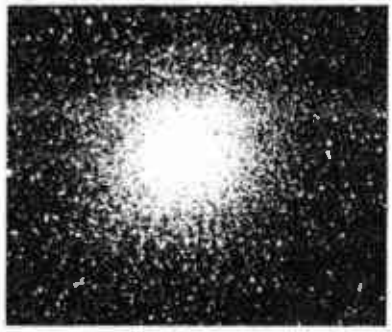
M72 is less a attractive glob but at 9th mag. is visible in small scopes. 56,000 l.y. away.

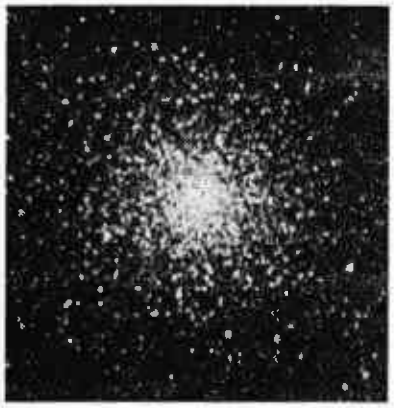
So there is a regular smorgasbord for you.

Good Seeing. ■

A Bob a Glob

It's easy to get blasé about globular clusters. I mean, they all look alike...right?





Above are M12, M13 & M14. But which is which? ■