MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal

PRIME FOCUS

Volume 1 Issue 9 **September 1996**

PRESIDENT'S REPORT

Once again a hearty welcome to all our members and guests. Many events are soon to take place with the society.

Firstly, as most of you should know on Sunday the 8th September we held an open day/night in conjunction with The University of Western Sydney which went extremely well.

Our **Christmas Picnic** is still on for Sunday the 1st of December.

Thanks must go to Peter Druery for a very entertaining if not slightly long talk on Star Wheels, Maps, Universal Time etc; The hand out was also especially helpful.

The world according to Garp (no Noel Sharpe, maybe someday I'll write poetry) is going to end. Tonight our VP will talk to us on the real danger Earth faces constantly from comets and other bodies intersecting Earth's orbit within close proximity.

As I see no opposition to the Name of ' Prime Focus', I would like to personally congratulate Bob on such an inventive and appropriate name of our Journal. Also thanks again all those who contributed to the Library and the Journal.

Finally, old Newsletters and Journals can be picked up from Noel Sharpe at the Macarthur Square Commonwealth Bank Mon-Fri 10am-4pm. This is in case any member misses out on an issue and wants to know what is going on. I would mail them but for the cost. The are now so thick they would cost a 90c stamp plus an A4 envelope.

CAMP CONSTELLATION

Though the camping site beside the river at Kangaroo Valley looked favourable for an Astronomy Camp (Bob and I went and investigated the camping facilities and space available), various logistics involved caused the committee to decide NOT to proceed with the camp at Kangaroo Valley for this year. Instead, for this year, on the 9th/10th November, we are investigating an alternative camping site closer to home and facilities. I will keep you informed.

MEMBERSHIP

As from this month a joining fee (for new members) of $10.00 plus the normal membership fee has been introduced. The payees from now will be covered till March /May 98.

LIBRARIAN'S REPORT

It is really great to see the interest in the library materials. However, please remember to return the items so other members can also make use of the books and items.

(Phil Ainsworth)

PRIME FOCUS

ISSUE 9 CONTENTS

MAS PUZZLE NO.2

Imagine that your spaceship has just landed on the moon. You were scheduled to rendezvous with a mother ship 200kms away, but the rough landing has ruined your ship and destroyed all the equipment on board, except for 15 items listed here.

The crew's survival depends on reaching the mother ship, so you must choose the most critical items available for the trip. Your job is to rank these 15 items in order of their importance for survival. Place a '1' by the most important item, a '2' by the second most important, and so on until you reach the least important, which should be ranked '15'.

------- Box of matches
------- Food Concentrate
------- 50 metres of nylon rope
------- Parachute silk
------- Solar powered portable heating unit
------- Two.45 calibre pistols
------- One case of dehydrated milk
------- Two 50kg tanks of oxygen
------- Map of the moon's constellation
------- Self-inflating raft
------- Magnetic Compass
------- Twenty-five litres of water
------- Signal flares
------- First-aid kit containing injection needles
------- Solar-powered FM receiver-transmitter

I hope you like this test of knowledge, though it is difficult. I only got 6/15 in order.

(Phil Ainsworth)

MARTIAN UPDATE

"This is an exciting time to be alive." These were the words used by NASA administrator Dan Goldin when the discovery of possible fossilised life on Mars was announced last month. I could not agree more, not only because of this recent discovery. Think back. We are the first humans to leave our home planet Earth and walk on the surface of a whole new planet. The Moon back in 1969 was one of, if not the most exiting time in my life and will live forever etched in my memory.

Now an even bigger adventure awaits us. Since 1976 when the Viking Landers touched down on Mars, no other space craft has returned. However, in 1988 Russia did send Phobos I and II with the latter taking some astounding pictures of Mars but failed (as did Phobos I earlier) just when it was to do the main part of its mission. Also Mars Observer failed to even reach Mars back in 1990-91.

Many probes in the past have been sent to the Red Planet with little or no success, so it's with hopes and prayers that the next three planned for launch later this year do not become plagued with unforseen problems.

As stated three probes are going to Mars and will arrive there from July-September in 1997. Here are the dates and a short run down on the expectations of each craft.

MISSION	SPACECRAFT	LAUNCH DATE	NATIONS
Mars Global surveyor	Orbiter	Nov.6-25th, 1996	USA

Comments:
Carries 5 copies of Mars Observers instruments; camera has been delivered to Lockheed-Martin Astronautics. French-supplied data relay system will send information from Russian and US spacecraft on Mars surface.

MARS 96	Orbiter,2 small stations & 2 penetrators	Nov 11-22,1996	Russia,USA ESA

Comments:
Visions of Mars CD, an anthology of sci-fi about Mars. Many different science instruments.

MARS PATHFINDER	Lander & Microrover	DEC 2-25,1996	USA

Comments:
Microrover, many different scientific instruments.

Every two years the US/Russia will send another probe to the Red Planet, with other nations also sending their own or assisting the bigger nations.

Mars Surveyor 98, Planet B (Japanese), Mars 2001(Russia), Mars Surveyor 2001, etc till 2005 when a sample return mission is planned. This may have been advanced due to recent discoveries. Also the ESA is planning a mission in 2005. Hopefully if the sample is proven or the many probes going to the red planet unveil past or present life, all the countries in the world can pool their resources and send a Manned Mission as early as 2008.

(Phil Ainsworth)

TUCANA - The Toucan

You've probably seen him trying to 'hold his beer' on the TV commercial. Now see him in the sky.

The Toucan is that large, vividly colourful South American bird with the outrageously large beak. In the late 16th century, Dutch navigators named this constellation which is seen only in the southern hemisphere, very close to the south celestial pole. In fact, it is virtually directly opposite the south celestial pole from the Southern Cross.

It can be found on your planisphere or star wheel between R.A. 1 hr and 22 hr, and Dec. -58° to -70°, though some of its associated features such as the Small Magellanic Cloud and the globular cluster 47 Tucanae lie just outside this range.

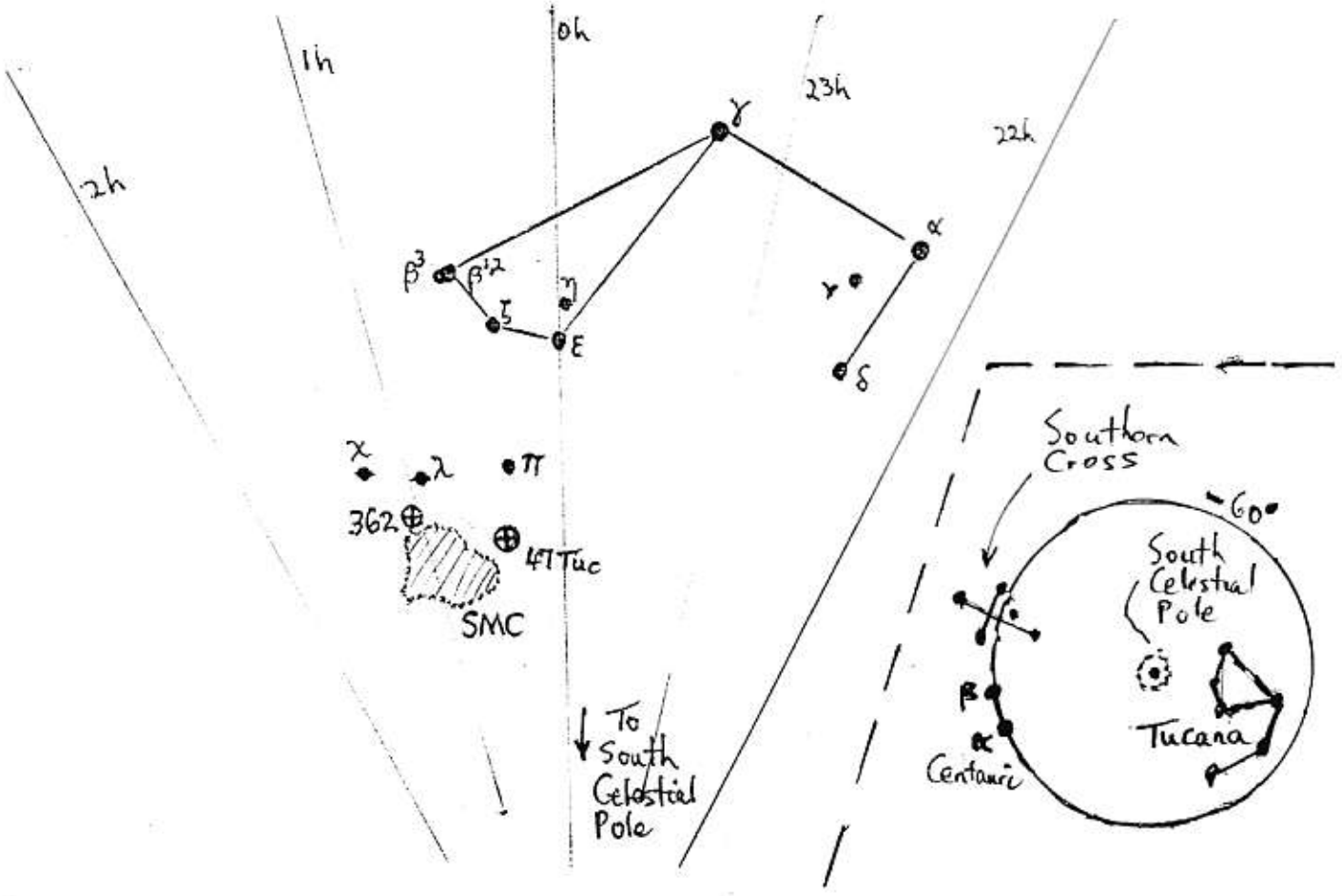
The constellation is shown in the diagram below:

α(Alpha) Tucanae (22h 19m, -60°) is an orange giant star, Mag. 2.9, dist. 120 l.y.

β (Beta) Tucanae (0h 32m, -63°) is very interesting. Binoculars or a small telescope (try this one Noel) reveal two blue-white stars of mag 4.4 and 4.5. These are called β^1 and β^2. However, β^2 is itself a close binary star. You'd need at least a 200mm scope to divide it. β^2's system has a period of 44 years. If that's not enough, adjacent to β^1 and β^2 is β^3, a white mag 5.1 star. All these seem to be travelling through space together, having identical proper motion., but their distances seem to belie this, being 275, 150 and 240 l.y. respectively.

γ (Gamma) Tucanae (23h 17m, -58°) is a giant white star, mag 4.0, 140 l.y. distant.

δ (Delta) Tucanae (22h 27m, -65°) is a blue-white star, mag 4.5, 270 l.y. distant. A small telescope may pick up its 9th mag. companion.



(TUCANA Cont'd)

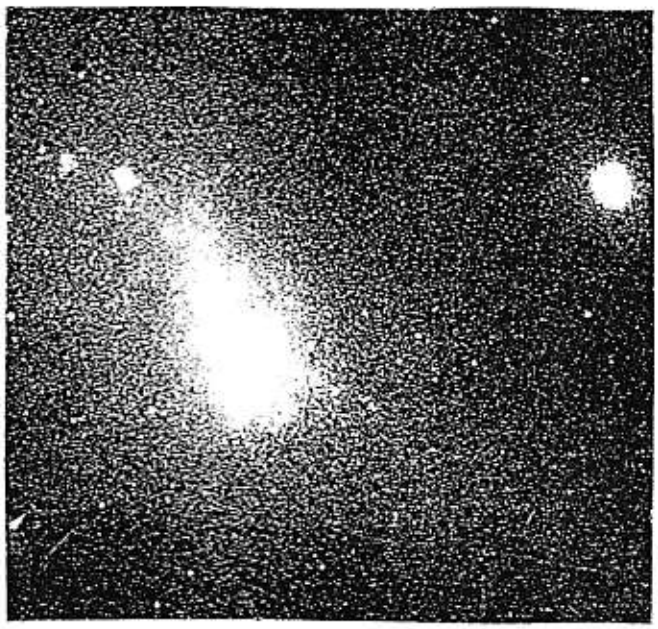
χ(Kappa) Tucanae (1h 16m, -69°). Though not part of the toucan's shape, is identified with this constellation. It is very close to the Small Magellanic Cloud (SMC). X Tuc. Is a double star. See if your small telescope can divide its 4.9 and 7.5 mag components. It should. They are travelling with a mag 7.2 companion. This star is itself a binary, divisible by telescopes of 150mm or larger. Try it!

47 Tucanae (NGC104) (0h 24m, -72°). A glorious globular cluster, second only to Omega Centauri. This is a 'must see' for binocular and small telescope observers. It is also visible to the naked eye (on a clear dark night) as a fuzzy star, mag 4. This explains its star designation on early star charts. You can start to resolve its stars on a scope as small as 100mm. Binoculars give a marvellous view of its cental core of stars. And it's only 15,000 l.y. away! An interesting fact about 47 Tuc. is that it is thought to be a prolific source of pulsars, thought to be caused by the interaction of stars at the cluster's dense centre.

NGC362 (1h 3m, -71°). Lying 29,000 l.y. away in our own galaxy, 362 is a globular cluster, mag 7.0, which can be seen by binoculars at the edge of the SMC.

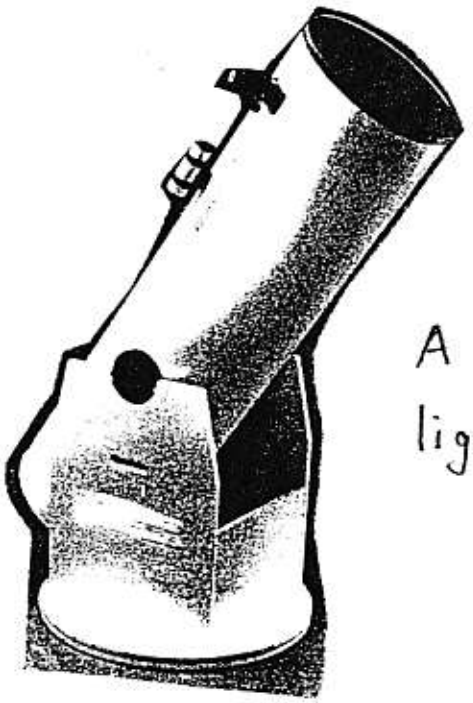
Small Magellanic Cloud (SMC) - not to be confused with Mono Sodium Glutamate (MSG). Like the Large Magellanic Cloud, this is a satellite galaxy of the Milky Way, lying about 190,000 l.y. away. The SMC can be seen by the naked eye, particularly on a dark clear sky, as a cloudy patch about 3.5° across. Through binoculars and small scopes, it reveals glowing gas clouds and star clusters. However, due to its close proximity to the Milky Way and the LMC, the SMC appears to be in the process of disintegration. Better hurry for a look.

(Bob Bee)



HST

Small Magellanic Cloud and 47 Tucanae (right).



A 16" (400mm) light bucket.

calculating

Redshift

written by Steven Manos

We often see astronomy articles and read that a new Quasar has been discovered with a reshift of 3.5, or a star has a redshift of 2.1. We often wonder what they mean by this and how it is determined.

An object that is redshifted (i.e. the light waves have become longer) is moving away from us. The lights wavelength changes because as it travels through space its energy lowers, thus lowering the frequency. An object that has blushifted (i.e. the light waves have become shorter) is moving towards us.

The redshifts and blueshifts of the spectra of stellar objects can be a determined quite easily. Here is the way in which they actually determine the redshift or blueshift of an object.

Firstly, the astronomer needs to determine two things;

a) the emitting wavelength of the object

b) the detected wavelength of the object

The emitting wavelength of the object can be determined by simply working out the chemical composition of the object, then the exact wavelength can be determined, showing what the wavelength would be if you viewed its light, for example, at its surface. The detected wavelength is the wavelength of light which we detect here on Earth, and through its journey through space, this light has either redshifted or blueshifted (ie. the wavelength has become longer (redshifted) or become shorter (blueshifted).

Once these two values have been worked out, the following formula can be used to calculate the redshift or blueshift value.

$$z = (\lambda - \lambda_o) / \lambda$$

where z is the redshift value (-z value implies a blueshift value), λ is the detected wavelength, and λ_o is the emitted wavelength;

or

$$z = (\Delta\lambda / \lambda_o)$$

where $\Delta\lambda$ is the difference of the wavelengths (detected wavelength minus the emitted wavelength).

Once z has been worked out the following formula can be used to calculate the speed at which the object is receding from us;

$$v = c(\Delta\lambda / \lambda_o)$$

Where v is the velocity of the object, c is the velocity of light.

So, for example, if you had a star which its detected wavelength is 496.3nm (nm=nanometres) and the emitted wavelength is 423.4nm;

$$z = (\lambda_r - \lambda_o) / \lambda_r$$

$$z = (496.3 - 423.4) / 423.4$$

$$z = 0.172$$

Thus the redshift value is 0.172.

Then if you wish to observe the speed of recession of the observed galaxy you would use the following:

$$v = c(\Delta\lambda_r / \lambda_o)$$

$$v = 3.00 \times 10^8 (72.9 / 423.4)$$

$$v = 51,653,282.95 \text{ m/s}$$

$$v = 51,653.3 \text{ km/s}$$

So the galaxy is receding away from us at the speed of 51,653.3 km/s.

Now for our friend the Hubble Constant. The following equation allows you to work out how far away a galaxy is in Mega parsecs:

$$d = cz / H$$

where d is the distance in mega parsecs, c is the velocity of light, z is the redshift, and H is the Hubble constant in km/s/Mpc

So, to work out the distance of our previous galaxy, we do the following:

$$d = 3.00 \times 10^5 \text{ km/s} \times 0.172 / 50 \text{km/s/Mpc}$$

$$d = 1032 \text{ Mpc}$$

but if the Hubble Constant used was 100 km/s/Mpc, then the galaxy would be 516 Mpc away.

For values of z greater than 0.8 and beyond 1 cosmological effects become important in determining distances, where other, more detailed equations are used (which are not shown here). These other equations allow for relavatistic effects to be accounted for.

Blueshifts only arise in a few nearby galaxies from either small random motions or because the Earth's rest frame is itself in orbital motion about the center of the Milky Way. And this is one of the most important aspects of Hubbles Law, that almost all galaxies have redshifted spectra. Therefore, the universe is expanding, the galaxies are flying away from each other. Another related aspect, the idea of Uniform Expansion, where the Universe is not simply expanding but galaxies that are further out are moving faster than those that are closer to us.

Currently the furthest known object in the universe is the Quasar PC 1247 + 3406, with a redshift of 4.9. It has an emmited wavelength of 121.6nm and a detected wavelength of 717nm.

VIKING

Twenty years ago Viking I and II were the first interplanetary spacecraft to successfully land on another planet. The Russians had tried several times throughout the 70's only to find that their efforts were in vain as each spacecraft either smashed into the surface or had flown straight past. The Viking I and II spacecraft journeying for over two billion kilometres safely landed on the Red Planet.

On July 20, 1976 Viking I parachuted down to a place called Chryse Plantia in the Northern Hemisphere of Mars. Viking II emulated its partner on 3rd September 1976. After much debate amongst the NASA scientists, safety was considered a prime factor in the landing site, hence the second site being Utopia Plantia. Both locations were not ideal landing spots to find life. It would be as if they had landed in the Sahara desert on Earth. Viking I and II after setting up camp looked around and saw a Geologists paradise (I bet they wish one of them was there first hand), but otherwise lifeless plains. Each landscape showed a surface littered with rocks with a pale pink atmosphere. Viking II was remarkably fortunate to survive the landing, for only 3 • metres away lay a 3 metre boulder later named "Big Joe".

Biologists by now were anxious to settle the question of whether life was present on Mars. Various chemical tests were performed in the small laboratories inside the Viking craft. After some tests, hope lay in the scientists minds for they found chemical reactions. This led biologists to believe small microbes might be present within the soil. However, after repeating the tests no conclusive evidence could be found to definitely prove or test out these puzzling results.

The tests performed by the Viking spacecraft were in three stages, so as to see if Microorganisms;
1. Manufacture food
2. Consume Food
3. Exchange any air.

1. Soil was placed in a small chamber of carbon Dioxide and Carbon Monoxide was added made of Carbon 14. The soil incubates under a lamp simulating Martian sunlight minus UV rays. The soil was then heated. The soil trapped in the chamber should take up the radioactive gases. It then lets other gases pass through it and past a radiation detector, then heated at a higher temperature so that other vapours can be released. If these vapours prove radioactive they are probably living organisms.

2. Organisms that are living must consume food to survive. They convert food into energy and then release Carbon Dioxide. Radiation levels are checked prior to the test. Martian soil and atmosphere is added to the chamber and sprayed with nutrient. These contain radioactive carbon 14. As the soil incubates a detector looks for any rise in radioactivity indicating Martian Microorganisms are metabolising. After 1-2 weeks the soil is re-squirted with more nutrient as the detector continues to watch for any reaction.

3. Living creatures are affected by their environment, just as people take in oxygen and breathe out Carbon Dioxide. So do Microbes; they produce gases that can be measured. The gas exchange experiment looked for these changes. Soil is placed in a chamber sealed to prevent leakage of a gas, and a nutrient was added in two phases.
I) Humid mode--just enough to humidify the soil
ii) Wet mode-- saturating the sample.

VIKING (CONT'D)

In wet mode, a nutrient takes several months to react. Strange results occurred after this time with large amounts of oxygen released, but when it was repeated on the same sample no reaction occurred. This caused scientists to believe it may have been only the Iron Oxide in the soil chemically reacting, not a biological reaction as hoped.

Both Viking landers did the same experiment with very similar results. Gasses were exchanged thus making it appear living organisms exhaled gases, but when both samples on either lander failed to repeat the same reaction on the same sample in both Martian and Earth like conditions the scientists were not sure what kind of reaction occurred.

While the landers were doing their job, the orbiters were completing another important task, they were mapping almost the entire Martian surface. The high quality pictures showed the world large mountains/ Volcanoes and old river canyons. The largest division ever found on a planet is the Valley Mariner (named after Mariner 9 which photographed it first back in the late 60's). The huge valley, if on Earth, would extend from Sydney to Perth long and is also up to 12 kilometres deep in some parts. It is believed water once flowed in many places on Mars, for evidence which seems impossible to refute are seen as dry river beds all over the surface which can only have been carved out by gushing water.

Viking I and II also recorded constant weather reports, the temperatures ranging from a very cold -33 C mid summer to -86C in the nights. However temperatures on the equator can reach up to a balmy 30C. As well they showed us winds up to 200km/hr and mighty dust storms which envelop the whole planet. However, with air pressure so low the equivalent on Earth would be felt like a 10-20 km/hr breeze.

Mars only has a thin wispy atmosphere 1/100th as thick as the Earths and an atmospheric pressure well below tolerable limits at 6-9 millibars. For water to exist on Mars in a liquid state, the pressure would have to be at least 30millibars.

Currently Mars is undergoing an ice age. As on Earth eons ago it started out warm and wet but lost its atmosphere due to loss of volcanism and a slow leakage of air escaping into space or into the rocks. Mars could not hold onto its air due to it being a little over • the size of Earth and much less gravity.

Realistically, Mars is a very inhospitable place. Despite this, it still remains the most Earth like in our solar system. There are many similarities between Earth and Mars which make it the prime candidate for colonising and making habitable.

1. Mars has a day nearly equivalent to Earth. Mars--24hrs.37mins whilst Earth has 23hrs.56mins

2. Mars has an atmosphere with thin clouds and dew, and the possibility of water as permafrost under the surface.

3. Mars has seasons (twice as long) as it is tilted at much the same angle as the Earth (Refer to previous Newsletter for statistics.)

4. The temperature whilst chilly at -86C at night, can make it up to 28-30C at the equator during midday in summer. However Earth can reach 55C in some places.

5. The gravity is 3/8th of Earth's, but quite liveable.

6. Mars also has minerals and resources

VIKING (CONT'D)

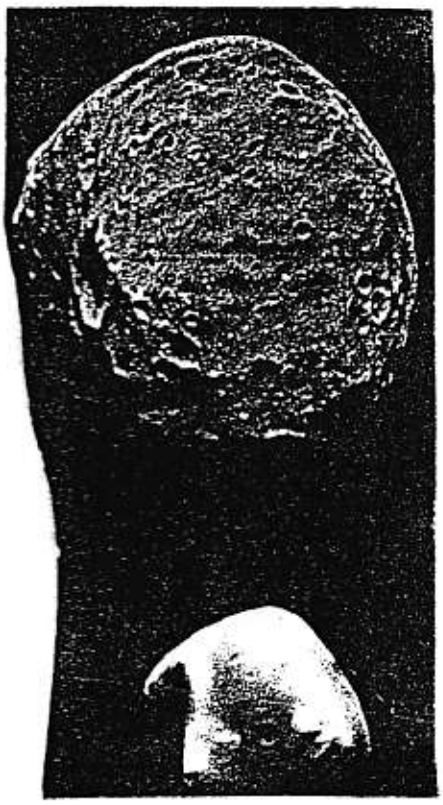
such as water and air which can be extracted fairly easily and so could sustain a colony and possible terra-forming to make it even more habitable.

Astronomers have long wished to see the Red Planet in such clarity, and with the aid of the Hubble Space Telescope it appears big, bright and still very red. Hubble has detected a change in Mars with the data telling us it is now colder than when Viking was there 20 years ago. This is and could be due to it being further away from the Sun and little or no dust storms have been present for the past few years. Dust surrounds the whole planet and envelopes it like a cloud or thicker atmosphere and thus causes Mars to be much warmer when storms are present.

Finally it must be said that these amazing little spacecraft broke all expectations by lasting several years and giving scientists a gold mine of data to study for many years.

The Viking spacecraft gave mankind their first close up peek of another world. Let's hope and pray the next three missions planned for launch this year, with some of them landing early next year, solve the long debate of whether life was or still is abundant on the Red Planet.

(Phil Ainsworth)



Phobos (top) & Deimos (bottom).

Olympus Mons. (NASA)

MY FIRST TELESCOPE

My introduction to the world of optics came courtesy of a pair of glasses when I was 4 years old. You know, the type with brown paper stuck to one lens so as to improve the strength of the other eye.

Strange to think that after 35 years, I'm still closing one eye and looking through the other. But this time for pleasure.

As a child, I was always fascinated by the properties of light and heat. Unfortunately many large colonies of ants lost their lives to the combination of my magnifying glass, my chemistry set and m microscope.

My first foray into telescopes came courtesy of the 1968 Royal Easter Show. I can't recall the name of the showbag but within its delights came a strange white tubular object. When held to one's eye and turning the focus, a fantastic kaleidoscope of fun was had by all.

Later for Xmas, Santa put a small white object with 3 legs into my stocking. "A small refractor, no doubt!" I remember saying after containing my Xmas morning excitement.

This telescope opened up a whole new world for me. Many hours were spent aligning the telescope on the old gas box. Like the Great Pyramids of Egypt, they act as shrines to past civilisations. Yes, the sturdy brick and cement topped gas box (complete with meter underneath) which adorned the front fence of many a home provided the most solid platform of all --- well it did stink a bit.

The objects observed were the local bike gang. In those days the bikers were 12 years old and rode Melvin Star dragsters with banana seats and cissy bars. Next wee the young girls playing netball and Mr and Mrs mason eating their lunch. The only time I ever looked at the sky was when I jumped on a bean bag floating in our Driclad above ground pool.

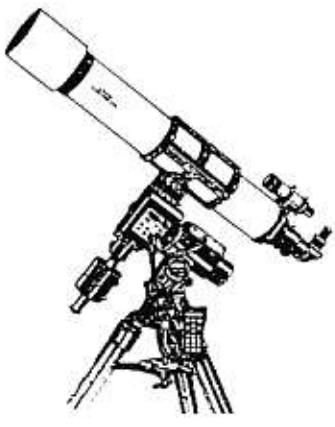
Years later, asked my parents to buy me a really big telescope just like my best friend's. His was a really big one and I wanted a really big one. I pleaded and begged, mowed the lawn, cleaned up all the rabbit droppings and fed our cat Tiddles. However, my dreams of viewing Saturn's rings were shattered when I sailed a soccer ball through the laundry window which, unfortunately was not only closed at the time, but had someone's mother doing the washing.

My father was furious and came running with eyes blazing. I was ready for the worse. What would my punishment be? Pointless washing the car for a year (we didn't have one). I already fed the cat. However, my dad had all the power. He simply said - "Well, you can forget about that stupid telescope." This indeed was a bleak moment in history.

I eventually got my telescope. Dad's a bit of a softy, really. With this new bigger telescope, I made some truly exciting discoveries:

The local bike gang had blackheads on their faces; the young girls playing netball were older and much bigger in all the right places; and Mr and Mrs Mason had chutney and salmon on their sandwiches.

(Noel Sharpe)



SOLUTION TO MAS PUZZLE NO.1

Some of the reasoning for the solution is provided here to assist in understanding the solution. This is one of those puzzles where the fun is in the process of solving it, not the solution itself.

The trick is to draw up an 8x8 matrix with the members' names along the top and the planets' down the side. Use the given clues to put crosses in those squares which are eliminated until only one square is left in a row or a column. Then **that** square tells you **that** planet is observed by **that** member. Give it a tick. Remember, once you have a tick in a square, then all the other squares in that row or column must have crosses. Fill them in. And so on.

The difficulty is to get the first ticked box. Then it's a breeze. Well, almost.

Some reasoning to be used:

General Clue: Each observer **does not** observe his/her namesake planet. Put crosses in the diagonal squares where the member's name equals the planet's name.

Clue 1: Mercury's and Mars's observers must be men. (His, not hers). Therefore, Miss Venus cannot observe them.

Clue 2: Mr Neptune's planet cannot be Mercury, Venus, Mars nor Pluto as they don't have four moons.

Clue 4: Jupiter's observer cannot be Messrs Saturn, Uranus, Mars nor Pluto.

Clue 5: Mr Saturn does not observe Neptune. Nor Venus. And you couldn't possibly mistake Venus for Uranus, Neptune nor Pluto., so it's not them.

Clue 7: Only planets outside Earth's orbit can be in opposition (to Earth). Therefore, Mr Pluto's planet cannot be Mercury or Venus.

Clue 8: Neptune and Pluto were discovered after Herschel died. So Miss Venus's planet can't be them.

It gets tricky at this point. Clues 3 and 6 give possible combinations of planets and observers. Each has to be tested against the matrix and crossed out wherever possible. Then - make an assumption and see if it leads to other crosses and ticks which give sensible answers.

At the end, every row should have ONE tick and every column ONE tick.

My major assumption (which led to a consistent solution) was that Miss Venus's planet was Uranus (discovered by Herschel). This was not necessarily obvious as he would have looked at other planets during his career. From this, I ended up with:
Mr Mercury (Jupiter); Miss Venus (Uranus); Mr Mars (Venus); Mr Jupiter (Neptune);
Mr Saturn (Mercury); Mr Uranus (Pluto); Mr Neptune (Saturn); Mr Pluto (Mars).

Fun, wasn't it?

(Bob Bee)