SCORPIO

Journal of the Astronomical Society of Frankston Inc

Vol 3, No. 5 P.O.Box 596, Frankston Victoria 3199 Oct/Nov 1994

FUTURE EVENT

GENERAL MEETING

19th October 1994

Topic - Astronomy in Holland

Speaker: Damian Renkin

16th November1994

Topic - Annual General Meeting

General Forum Discussion

Come armed with questions

VIEWING NIGHTS

See Page 2

COMMITTEE MEETING

The committee will be held at the Brown's residence on:-

27th Oct 1994

24th Nov 1994

The Astronomical Society of Frankston was founded in 1969 with the aim of fostering the study of astronomy by amateurs and promoting the hobby of amateur astronomy to the general public. The society holds a General Meeting each month for the exchange of ideas and information. Regular observing nights, both private and public are arranged to observe currently available celestial objects. In addition the Society provides the services of its members for educational presentations or observing nights for schools and local community groups.

HELP !!!!!!

We need help in three areas.

Committee Members.

November is our Annual General Meeting and the committee for next year will be elected. Some of the 1994 committee members may not be able to contribute next year for personal reasons and we need to elect some new committee members. The Society has undergone a lot of development in the last few years and we don't want to loss this momentum. If you can contribute why don't you consider helping out on committee.

Future Directions

At the November meeting the committee wants to explore the future directions of our Society and clarify what our members want. Have a think about why you have an interest in astronomy and what you want to get out of our society. Remember if the members don't say what they want, you won't get the most out of the society.

Scorpio Contributions.

It has been very difficult to get out the last few issues of Scorpio. Work constraints have limited how much time I can put into generating the magazine. As always contributions from members helps enormously. Why don't you have a think about something you can contribute to the magazine. It doesn't need to be technical, could be a yarn or a discussion piece. Those of you with computers please send files in DOS text or ASC format.

FOR SALE AT MEETINGs

Society Badges $5

Planospheres $8

Telescope Making Equipment

Mirror Blanks, Grinding & Polishing Compounds, Spherometers, Eye-pieces, Secondary Mirrors, Spiders

Meeting Venue:

The Peninsula School

Wooralla Drive, Mt Eliza

(Melways Map 105, F5)

Room F6 at 8.00pm on the third Wednesday of each Month

Visitors are always welcome

Annual Membership Fees

Full Members	$20
Concession Members	$15
Family Members	$30
Family Pensioners	$25

Membership Fees due 1st January each year

President

Peter Lowe 018 318 920

Vice President

Peter Skilton (03) 776 5898

Treasurer

Peter Brown (03) 789 5679

Secretary

Don Leggett (059) 85 4927

Committee

Ros Skilton	(03) 776 5898
Tony Hales	(03) 781 3251
Laurie McIntyre	(03) 786 6120
Steve Malone	(03) 789 6239

Don't forget if you have any comments or contributions - please contact the Editor

Society Meetings

August

The August general meeting was chaired by Peter Lowe and was well attended when over 50 people showed up, including many new faces. The usual format was followed. Peter presented the normal preamble, followed by Bob Heale presenting his Sky for the Night. His material on the night sky is generated on computer programs he developed himself. Peter Skilton then presented upcoming Phenomena and major happenings that have recently been reported, including feedback on details from the impact of Shoemaker-Levy-9 with Jupiter. Colour images of the impacts were then handed around for all to see.

After coffee, the attendees split into 2 groups. One group attended a session presented by David Girling, intended to introduce and reinforce basic concepts in Astronomy. These are always popular, particularly amongst newer members. The other group attended a parallel lecture on Comets, Meteors and Planetary Impacts given by Peter Skilton. This one was originally prepared for presentation during the June/July series of lectures for members at The Briars. This presentation was backed by many slides on the subject and was well received by members and new comers alike. The meeting finished quite late, near 10:30 pm and as a result some members had difficulty leaving the school grounds because the front gates had been locked. In future, we will aim to finish between 9:30 and 10:00 pm.

September

The September meeting was chaired by Peter Skilton, and again was very well attended, when over 50 people fitted into the room, including 2 new members who joined on the August ranks of our Society on the night. After some drama concerned with the overhead projector bulb having blown, Peter presented information on current and upcoming Phenomena. This was followed by Bob Heale presenting his Sky for the Night, and Don Leggett providing feedback from the last Committee Meeting. This last item proved most popular, with interest being generated in members with respect to the proposal for establishing an future lease at The Briars. After breaking for coffee, the gathering reconvened at one of two parallel sessions.

David Girling assembled a telescope in one room and conducted a popular forum concerned with observing and instruments. He indicated during the meeting that future topics might include Deep Sky observing, which has been missing now for some time. Next door, Peter presented a video on Comets, from which only small segments had been shown previously. This provided good reinforcement of concepts presented at the August meeting, and included spectacular time lapse television pictures of comet p-Halley moving across the sky in 1986, and of the approach to p-Halley by the European Space Agency's Giotto probe as it hurtled suicidally at the nucleus in the same year. The latter time sequence of images from 1 million kilometres away from the core to only just a few hundred kilometres has never been shown on television before. The meeting wound up at 10:00 pm.

October

At the October meeting new member Daimen Renkin will give a talk on "Astronomy in Holland".

Left - 25th Anniversary Dimmer at Baxter Tavern 6th August 1994

Event Calander

8th Oct - Members viewing night at the Briars. As usual there is a BBQ prior to the viewing. {BYO everything}.

This is an astrophotography night so you can try your hand at the various types of photography. Telescopes will be available for members to test their photographic skills. Don't forget to bring your camera and some film

23rd Oct - Astronomy Day at the Woodleigh School. This is a Sunday 9.30am till 3pm astronomy day. We need volunteers. Come and join the fun.

19th Oct - Monthly General Meeting

2nd Nov - Annual Society Dinner. Venue yet to be established

12th Nov - Public Viewing Night. Ballam Park. Viewing starts 1. BBQ from about 6pm

10th Dec - Society Christmas BBQ

Member Almost Visits Mauna Kea

Recently, Rene Skilton had the good fortune to visit Hawaii. During the stay she was given instructions to "at least see the famed astronomical observatories at Mauna Kea while there". The finer points of these instructions were duly forgotten once on the island, and were reinterpreted as "get to observe through the telescopes at Mauna Kea while there".

A local phone call to the University that runs the facilities was apparently made, and it was pointed out that she was a member of a renowned Southern hemisphere astronomical society, the Astronomical Society of Frankston, and would like to see the night sky through their mountain top facilities.

Amazingly, they were more than happy to oblige with her request to observe through the most powerful and advanced optics on the planet!

No problems with being an amateur.

All that was required first was a 2 year wait and $10,000 per hour!

WHAT'S NEWS IN ASTRONOMY

CLEMENTINE.

On May 7th this year mission control test fired the small thruster jets of the Clementine space probe. The jets fired successfully but a software glitch kept them burning until the craft's fuel exhausted leaving it in an uncontrollable spin. While the mission managers try to determine if there is any life left in Clementine, it is worthwhile reviewing what the craft has done for us.

Clementine is a new breed of lightweight, low cost, off the shelf spacecraft that NASA believes is the way of the future in solar system exploration. NASA has learnt the lesson that large, expensive and specially built spacecraft while delivering vast quantities of data are highly susceptible to failure and if lost is a publicity nightmare. The American people want successes and funding is becoming very tight, even to the point that the American space-station Freedom is very likely to be strangled due to fund constriction. An alternate approach is to produce small, low cost probes using existing off-the-shelf technologies. The probes are designed to meet very specific mission needs and several probes would be needed to cover the explorations previously carried out by their larger, more expensive relatives. The loss of one probe would not greatly affect the overall mission series and another probe could be sent without too much loss of face or money. The loss of the Clementine craft {compared to the recent loss of the Mars Observer} seem to bear out this philosophy given the craft was built in only two years and cost a mere $75 million.

The Clementine spacecraft has been scanning the lunar surface producing a digital map made at 11 separate wavelengths. This much colour data will allow geologists to better understand the distribution of rock types and from this the geologic history of the Moon.

In addition Clementine has conducted detailed studies of the moon's topography and gravitational fields. Surprisingly the range of elevations on the moon is much greater than expected. A major discovery was the existence of one of the largest basins: the Aitken Basin near the south pole on the lunar farside. At an average 14 kilometres depth the basin covers about a quarter of the moon's circumference. Within this south pole region, Clementine found craters where the crater floor never sees sunlight. This has sent planetary scientists into a bit of a frenzy because of the possibility that lunar ice many still exist.

The loss of the Clementine probe has put pay to any further mission objectives. Despite the loss, the philosophy of using small, cheap and quickly made crafts seems to have been proven and no doubt follow up probes are being designed.

INTERSTELLAR DUST.

Using the Hubble Space Telescope astronomers have been able to measure the concentrations of heavy elements in interstellar dust. The detected elements include gallium, germanium, arsenic, krypton, tin, thallium and lead.

Using the bright blue star Zeta Ophiuchus astronomers detected the spectra of the elements in the star's ultraviolet spectra. As light from the star travels to us on Earth the intervening gas and dust selectively absorbs characteristic wavelengths from the UV part of the spectra. Knowing the concentrations of heavy elements will help solve some of the long standing problems about the origins and composition of interstellar material.

More work is required to confirm the effectiveness of the measurement method and if confirmed can be applied to other blue stars. This would enable astronomers to check how evenly elements are distributed.

MARS A QUIET PLACE

The planet Mars is believed to have been geologically active for about half a billion years after its formation and has been basically inactive ever since. Using the NASA Extreme Ultraviolet Explorer satellite to determine the amount of helium in the Martian atmosphere, scientists believe they have confirmed this geologically inactive state. Helium is produced from the radioactive decay of uranium and thorium inside the planet. It is released into the atmosphere by geological processes such as volcanism or earthquakes {Mars-quakes ??}

The measurements indicate helium is concentrated at about one part per million which is 30 times less than on Earth.

NEW GALAXY in LOCAL GROUP.

Our galaxy The Milky Way is a member of a cluster of galaxies called The Local Group. This local group has been well known for years. You can imagine astronomers surprise when a new local group galaxy is discovered. At an IAU meeting this August, astronomers announced the discovery of a new galaxy in the constellation of Cassiopeia. The galaxy which is about two-third the size of the Milky Way was discovered during a radio survey to find obscured galaxies. Known as the Dwingeloo galaxy after the Dwingeloo radio telescope which detected it, it appears to be a gas rich spiral. The galaxy has not been seen before because it is heavily obscured by dust in the Milky Way. A re-check of red light photographic plates shows a small and extremely faint smudge from the central part of the galaxy. Follow up observations using the 3.8 metre UK Infrared Telescope has detected a signal from the central star forming region. While the distance to the Dwingeloo galaxy is uncertain, estimates put it at about 10 million lightyears which puts it at the extremities of the Local Group.

SUMMER SPACE SCHOOL.

During July this year Simon Hamm attended the Australian International Space School. Simon, one of our younger members was awarded a position at the school. Below is a short note on his time there.

On the 9th of July, one hundred and three students and teachers boarded planes destined for Sydney and the Third Australian and International Space School. (AISS) The AISS was held at the University of Sydney form the 9th to 14th of July. After everyone had settled in and unpacked, Australia's only astronaut to fly in space Dr. Paul Scully Power gave us a lecture about his experiences in space. Later that night everyone was split in to equal groups. Each group was shown space simulations on Apple Computers (but they were not very good), given a view of what to expect in the night sky by the use of an Astrodome and lastly everyone experienced zero gravity by using a Space Ball machine. That was good. On the second day we heard two lectures, one on Australian Space History and the other on Remote Sensing which is mapping city density and geological features of the Earth by infra red satellites. Later we were given a tour of the Qantas Training Center and were shown the Sydney Harbour Bridge, the Rocks, Opera House and the Sydney Observatory. At 4:00 the next morning I awoke and got on a bus to Canberra. While in Canberra we heard a lecture from The Australian Space Office, were given a tour of the Canberra Observatory and a tour of the Tidinbilla Tracking Station. On Wednesday the 13th of July, we were all whisked off to the Power House Museum in Sydney for a direct live satellite link up with an American TV show. After lunch everyone went to a presentation where John Young, America's most experienced Astronaut, gave moon rocks to the people of Sydney. Next the group saw Australia's first viewing of the movie, For All Mankind. It was a 25th anniversary tribute to all of NASA's Astronauts. The last day had finally arrived and the media had arrived in all its forms. The children's TV show "Wonder World" had arrived to film rockets being fired, and five newspapers interviewed people. All up it was a good week.

Simon Hamm

Herald - Bobroff Atlas

I received my copy of the recently released Herald - Bobroff ASTROATLAS this week. This star atlas consists of six series of star charts with different scales and projections.

The A series covers the whole sky and generally shows the distribution of objects.

The B series is visually similar to the "Norton" atlas format but more detailed due to the nature of the special symbols. The B series is used to quickly locate the brighter and most spectacular astronomical objects. Interestingly the charts are replicated three times. In addition to the B series charts, there are the BS and BM charts.

The BS charts are identical to the B charts except south is at the top of the page. A highly civilised modification for us southern observers.

The BM charts show only stars and each star is labelled with its visual magnitude.

The main series of charts is the C-Series. It consists of 94 charts at uniform scale plotting all stars down to 9.0 visual magnitude and non-stellar objects down to 14.0 mag.

Some areas of sky are so crowded in the C-series a further 42 charts are supplied in the D-Series. The scale of these charts has been adjusted to best represent the region plotted.

The E and F-Series concentrate on the Magellanic Clouds, the Virgo cluster and the eta Carina regions. The F-series shows the central region of the Large Magellanic Cloud with stars to 14th mag and non-stellar objects to 15th mag.

The symbols used in this atlas are unique in the level of information they contain. It was obviously an objective to maximise the amount of information for the user. At a glance an observer can see the spectral type of a star, the orientation, type and size of a galaxy or the size and type of a planetary nebula. This is obviously a strong point of the atlas.

With the sort of weather we've been having lately, I have yet to use my atlas but I already consider it to be a valuable addition to the library.

The B-Series would suit the new starter well allowing a natural progression onto the more difficult charts. The Astroatlas costs $90 including postage and is in my opinion real value for money.

Purchases by writing to:

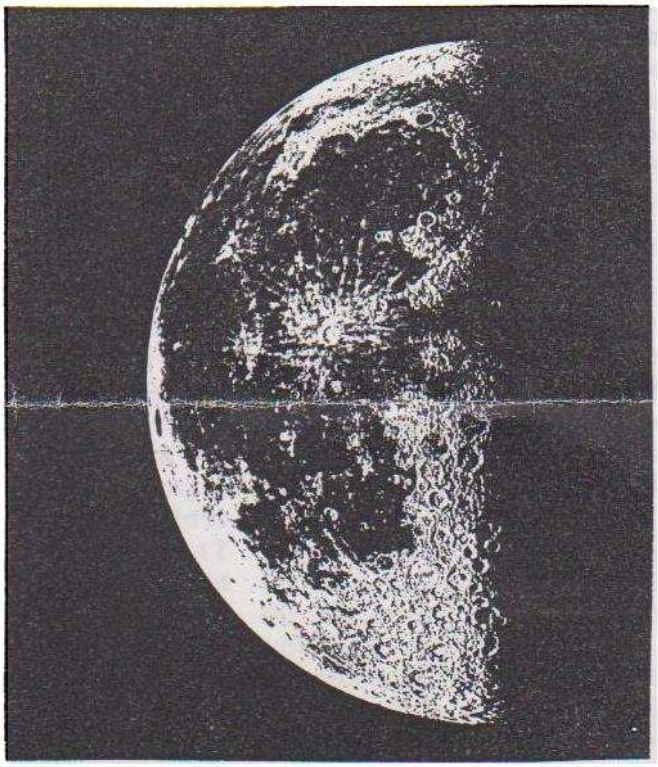
HB2000 Publications

P.O. Box 254

Woden

ACT 2606

The Moon: A Planet under our Noses



Like many amateur astronomers the first object I ever really observed was the Moon and like many amateurs I quickly lost interest in the Moon regarding it as a bit of a nuisance fit only for public viewing nights. After all, bright Moon shine just gets in the way of those really interesting deep sky objects. Well I'm changing my mind. Since discovering some of the possibilities of video astronomy, lunar observing is becoming a regular pastime. The development of light weight CCD video cameras connected to your telescope is a powerful tool and video recording a great way to save an observing session. After our winter lectures I was asked if we could have a talk on the Moon and so I have started to collect my notes.

The Moon has a special place in our night sky. It is after all direct evidence that we live on a planet. More than any other object in the heavens, the Moon sails gracefully across our skies as it orbits the Earth. Each night we can see a sort of living geometry in its movements as the lunar phase progresses in a never ending sequence from new to full Moon and back again. The first glimpses of a slender, tapered crescent just after New Moon always invoke a bit of emotion at sunset. As we shall see later the Moon is really a part of the Earth and well worthy of study as a planet in its own right.

THE HISTORY OF THE MOON.

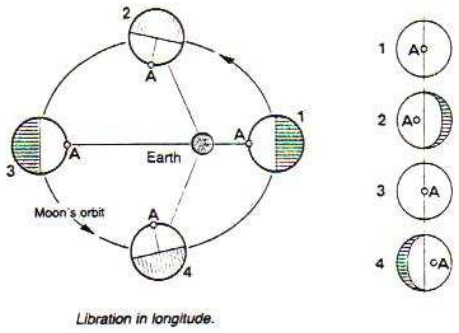
The Earth/Moon system is more correctly a twin planet system. A study of the lunar surface is a sort of Rosetta stone of solar system history. We now know the gas giant planets are concentrations of materials formed at the same time as the Sun. The rocky planets such as our Earth formed a little later as the last remnants of the gas and dust spiralled into toward the newly formed Sun and coalesced into the inner planets. This rocky planet formation was a period of violent accretion of material by collision. The recent collision of Comet Shoemaker-Levy was a live example of the planet building process in action. We know the Earth formed during this accretion period but it is not known just how the Moon formed. Some theories claim the Moon formed as a separate planet and somehow the early Earth and Moon were able to become gravitationally locked in orbit about each other. There are real problems explaining how this might be achieved without some method of absorbing orbit energy of the two planets. The favoured version for lunar formation is a slight variation on this theme and suggests the Moon was born during the violent impact between a slightly smaller early Earth and Mars sized planet. This Mar sized planet, let's call it "Thor" after Thor's hammer, struck the Earth a glancing blow being totally disrupted in the process and blasting a goodly proportion of the Earth's crust and mantle out into space. The Thorian core merged with the Earth and sank into the planet. Most of the blasted material fell back to Earth, however some material settled into orbit and became our Moon. While this scenario is thought to basically explain the lunar formation, there are still problems explaining how the Moon achieved such a circular orbit.

However the Moon formed in detail, samples returned after the Apollo lunar landings have been dated at 4,200 million years old, close to the known age of the Solar System. From the Apollo missions we know the lunar surface is totally covered with craters. Some regions are heavily cratered while others appear smooth from Earth. Galileo discovered mountains and craters on the Moon in 1610 and within a few decades there were lunar maps showing mountains, craters, riles, domes; a whole plethora of lunar surface features. The surface bombardment by meteorites plus general heating from decay of radioactive elements seems to have melted the lunar core. Lava flows are evident across the lunar surface and broad dark maria easily seen to the naked eye are giant lava fields that have filled the surrounding craters leaving a smooth surface. The two main surface types visible are the rough, cratered highlands and the smooth, featureless lunar mare. Geologically the Moon is almost dead these days. Seismic activity is very slight and moon-quakes are typically in the range 1-2 on the Richter scale.

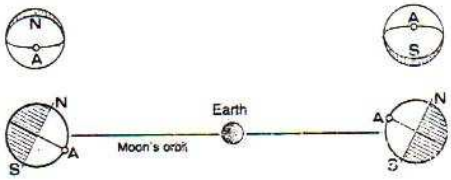
Hardly noticeable. The most violent seismic events are probably the impact of larger meteorites. Seismometers left on the lunar surface detected about 50 - 70 meteorite impacts per year. {Wouldn't it be great to witness one of them !!}

LUNAR ORBIT.

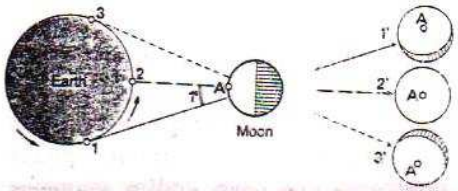
The Moon and Earth are gravitationally bound together and orbit each other. The actual path the Moon takes through space is extremely complex and very hard to predict in the long term. You need to remember when observing the Moon that its appearance is affected by a number of factors: principally the Earth and Moon orbit each other, the Earth/Moon system orbit around the Sun, the Earth rotates once per day, the Moon rotates once per month and various randomising influences. To understand the basic apparent motions of the Moon we consider a simpler model and assume the Earth is fixed and the Moon follows an elliptical path or orbit around the Earth. {see diagram 1} An elliptical orbit means the distance between the Earth and moon is constantly changing from a minimum 356,400 km to a maximum of 406,700 km. The point of maximum distance is called the apogee and the point of closest approach is called the perigree. Thus the Moon effectively falls about 50,000 km from apogee to perigree and then climbs back up 50,000 km to apogree. While the Moon falls toward perigree its speeds up and then slows down again as it climbs to apogee. From an observers viewpoint these changes lead to two direct effects. Firstly the Moon's apparent size changes because it is physically closer to us at perigree than apogee and secondly the Moon's apparent speed across the sky changes. At apogee the Moon moves at about 12 deg/day while at perigee it can reach speeds of 15 deg/day. This suggests two interesting experiments. Try taking a photograph of the Moon at apogee then at perigee and compare the size of the two images. Try measuring the speed of the Moon by noting its position relative to the background stars and calculate its speed. {What's its actual speed? } The Moon's orbit is not co-planar to the Earth's equator. In fact the Moon's orbit is inclined about one degree to the ecliptic. Furthermore the Moon's equator is inclined 6 degrees to its orbital plane. Thus as the Moon orbits the Earth observers see it from differing perspectives. The combination of size and speed changes together with the varying observing perspectives and the fact that we observe from a rotating Earth leads to some interesting effects.



Libration in longitude.



Libration in latitude.



Diurnal libration.

Long ago gravitational interactions between the Earth and Moon dragged the Moon into synchronous rotation. The rotational and orbital period of the Moon is such that the same hemisphere faces the Earth. The backside of the Moon remains hidden from us except by spacecraft exploration. At any point in time we can only see 50% of the lunar surface however apparent swings in the observers perspective called librations enables the observer to see about 59% of the surface area. There are three types of librations:

* Libration in latitude
* Libration in longitude
* Diurnal libration

Libration In longitude is caused by the fact that the axial rotation of the Moon is constant while its orbital speed is constantly changing. As the Moon moves from apogee to perigee it traverses half of its orbit but at the slowest part of the orbit the Moon is rotating too fast to maintain the same face toward us while at the fastest part of the orbit the Moon is rotating too slow. Overall the Moon rotates once per orbit but at different times to the orbit it presents a slightly different perspective. Libration in longitude can cause an east-west displacement of 7deg 54min.

Libration in latitude is a consequence of the Moon's equator being inclined to its orbital plane. This tilt of 6 degrees inclines firstly one pole then the other pole toward the Earth as the Moon orbits. To an Earthbound observer the Moon appears to tilt back and forth from month to month. Diurnal libration is a smaller effect of only about one degree and is caused

by the varying perspective the observer sees from moonrise to moonset. As the Earth rotates the observer sees the moon from a different viewpoint. A fourth type of libration called physical libration is caused by gravitational irregularities in the actual rotation of the Moon and while very small { a few arcsec } are important in studies of the Moon's inner structures.

JAPANESE SPACE PROGRAMME FOR 30 YEARS.

The Japanese Space Activities Commission has released its plans for a 30 year space programme. The plan included seven orbiting fuel stations and an operations centre in low orbit for the repair and maintenance of satellites. Several transport vehicles would be needed to support the assembly of space craft. The plan also included a Moon base and manned expeditions to the planets. While the plan is seen as very ambitious, it sets out the vision for the future.

MURCHINSON 25 YEARS LATER

During the last week of September, the town of Murchison celebrated the 25th anniversary of the fall of the famous Murchison meteorite. A little before 11am on the 25 September 1969 the people of Murchison were going about a quiet Sunday mornings business when there was a sudden explosion about them. People went out to look around but nothing was evident. Some saw the long smoky clouds in the sky and there was a smell of methylated spirits in the air. Apart from a talking point no-one realised what had happened. There were reports on the news that night that a fireball had been seen across NSW and it was thought a meteorite had fallen to ground. The next day people started to find odd grey-black material around the district and the hunt for meteorites was soon in full swing. Twenty five years later the Murchison township decided they would like to celebrate the meteorite fall. Under the support of the Murchison Tourist Promotion Group inc a weekend of celebrations was organised including guided tours, telescope raffles, a meteorite birthday cake and stargazing courtesy of the Astronomical Society of Melbourne.(???) My wife and I decided it would be a nice day trip to drive out to Murchison and join in. It was a great day. I wished later I'd brought a video camera because of the number of stories still being told. I realise that here was a town where the people had witnessed something almost unique: the explosive peppering of the town and district with meteorites. Almost everyone had a story to tell. some as adults working in the area and some as childhood memories.

* Mr Brisbane had just finished cleaning the work area of his dairy and when he went out after hearing the explosion found the area covered with greyish powder. He swept the material away and fixed the fence. Later scientists were searching his cess pool for meteorite material.

* Mrs. Lyons was playing golf when she found a rock on the putting green. Knowing this would foul the mower she picked it up and threw it under a tree. Later realising what the rock must be she went back with her husband and recovered the rock.

* Another man was driving his car and it was hit by something. He didn't stop but found the car was damaged when he got home. Returning the point were the car was hit, nothing could be found.

* One lady had just finished mowing the lawn and was complaining about damage to her shrubs. When her husband went to inspect, he found a black rock was dug into the base of the shrub.

* Some children showed their father some funny rocks they had found. After contacting a local gemologist they realised the rocks were meteorites. A quick search of the area found many other bits including the biggest piece found buried in a hole blown into the grass.

The largest piece found was on display in a glass case. Under the watchful eye of an armed guard {yes, I do mean armed} visitors could get a good closeup view of the meteorite.

An interesting story came from our tour guide. He heard the explosion and thought it was a sonic boom. The Vietnam war was still on and jets often traverse the skies. Outside he saw long brownish clouds and he thought at first a plane had crashed. There was a smell in the air like methylated spirits. Later he got caught up in the meteorite hunting. At one stage there were dozens of people combing his fields. None of them asking permission he recalls. He still has some samples of the meteorite in glass bottles and told us he'd opened one of the bottles that morning and it still had the same smell after 25 years. Fascinating, I wonder how many people have been lucky enough to be able to smell gases from a meteorite. The day was certainly worth the three hours driving and anyone wishing to explore the area, a commemorative display was unveiled showing some of the history of the meteorite. The people of the town seem more than willing to tell a yarn or two about their recollections and it is a unique opportunity to meet people who have witnessed first hand the end of a fireball. Who says there's not a treasure at the end of a rainbow?

Peter & Vivienne Lowe

For the record, the Murchison meteorite is a carbonaceous chondrite type CM2; a rare type. About 100 kg of material was recovered with the largest piece weighing about 7kg. Analysis of the meteorite material revealed some seventy odd types of amino acids. The presence of amino acids shows complex organic molecules can survive in space.

Carbonaceous chondrite meteorites are extremely rare and literally worth their weight in gold. I guess this explains the presence of the armed guard.

BLACK HOLES ARE REAL

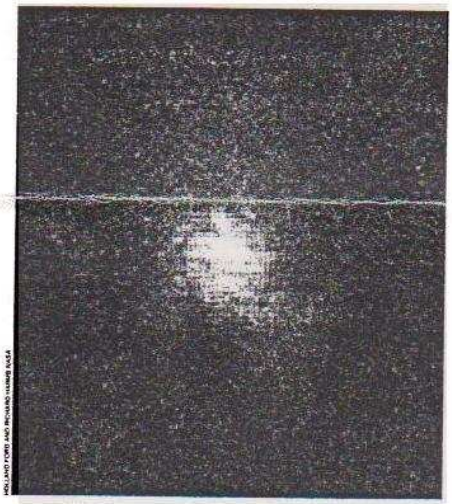
As any Startrek fan will tell you, one means of deduction is based on the Sherlock Holmes maxim *"If you eliminate all that is possible, then what remains must, not matter how improbable, be accepted as truth"*. The search for Black Holes has been a sort of astronomical quest for Holy Grail ever since theoretical physicists first postulated the possibilities. Originally black holes were considered to be theoritical objects only, quirks within an incomplete theory of gravitation and far too wierd to exist in the real universe. If the mass of an object such as a star is slowly increased in passes from ordinary star to massive star to white dwarf to neutron star. Beyond a few solar masses, theory predicts the neutron star phase is not totally stable and eventually a star contracts to the point where the surface gravitational field is strong enough to prevent light from escaping. The name Black Hole is intended to convey the idea of light going into the star but not coming out. To the outside observer it would appear as a black hole in space. {if you could get close enough}

The search for black holes has been a perfect example of Sherlock Holmes maxim. It is not possible to directly observe a black hole but the evidence for the reality of black holes is slowly and steadily building up. The first searches for black holes concentrated on identification of X-ray sources. Early studies showed many X-ray sources were binary stars containing compact objects such as neutron stars. Some of these studies suggested the stellar masses involved were beyond the limit where black holes form. Unfortunately as data has improved the results are falling within the neutron star mass ranges. While slow addition of matter to neutron stars may eventually form a black hole this does not appear to be a common occurance and astronomers started to look elsewhere.

The first evidence for another line of investigation was coming from radio astronomy. Radio galaxies and quasars were being investigated and in particular the high velocity jets of ionised matter seen to be eminating from their cores. Very large scale radio interferometry enables astronomers to generate high resolution images at radio wavelengths. Where the resolution limit of optical telecopes is around 0.5 arcsec, radio interferometers could achieve 0.0001 arcsec resolution. While the matter jets were massive objects extending over distances of several galaxy diameters, their source was traced back into the very heart of the radio galaxy. In fact the jets originated from a region only a few light years across. The hunt for black holes at the core of galaxies was on in full.

Optical telescopes could not match the resolution of their radio counterparts but the optical evidence was building up. Theoretical models of galaxies suggested stars followed normal orbital paths. If this was the case the velocity of stars at different distances from the galactic core should steadily increase. When this was checked for a number of galaxies the results did not match theory. The stellar velocities seemed to match theory near the central region however stellar velocities were almost constant further out. This strongly suggested much more matter was present than could be seen as stars. Astronomers started looking in two directions: firstly for the missing matter and secondly spurred on by the radio images of the activities of stars near the centre of galaxies. Some astronomers were suggesting some galactic cores might contain black holes of millions, possibly even billions of solar masses. It was found that many galaxies had bright pointlike sources and detailed studies of the stars near the galactic core suggested high velocities. The evidence for massive black holes at the galactic cores was building up. Unfortunately these studies have had to wait for the repaired Hubble to fill in the fine detail. Scientists using the Hubble have studied the inner region of M87, a hugh elliptical galaxy in the Virgo cluster. M87 was one of the early radio galaxy discoveries and become an engima when optical photographs revealed an optical jet. Radio interferometry has shown the jet to originate right from the galactic core itself and now optical astronomers have had the opportunity to measure gas velocities with 60 lightyears of the core. They have found velocities around 750 km/sec suggesting a central mass of 2-3 billion solar masses. The gas disc at the core is orientated approximately perpendicular to the observed gas jets, exactly as theory predicts. While we may never be able to view a black hole directly, just how much evidence is enough before them reality must be accepted. As the evidence has built up over the past 30 years, Sherlock Holmes maxim has become more relevant. Observations it seems, have eliminated all possible alternative explanations, bar one and when you eliminate all that is possible, then what remains must, not matter how improbable, be accepted as truth.

Peter Lowe



ROTATING DISK at the heart of the galaxy M87 was discovered using the Hubble Space Telescope. The hot gas probably orbits an unseen black hole at the center.

Right - 25th Anniversary Dinner at Baxter Tavern 9th August 1994

Photo - *By John Cleverdon*

Right - Society Dinner at Baxter Tavern 23rd November 1994

Photo - *By John Cleverdon*